



US006257574B1

(12) **United States Patent**  
**Evans**

(10) **Patent No.:** **US 6,257,574 B1**  
(45) **Date of Patent:** **Jul. 10, 2001**

(54) **MULTI-POLYHEDRAL PUZZLES**

5,407,201 4/1995 Whitehurst ..... 273/157 R  
5,660,387 \* 8/1997 Stokes ..... 273/157 R

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\* cited by examiner

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

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(57) **ABSTRACT**

(21) Appl. No.: **09/370,929**

(22) Filed: **Aug. 5, 1999**

**Related U.S. Application Data**

(60) Provisional application No. 60/104,666, filed on Oct. 16,  
1998.

(51) **Int. Cl.**<sup>7</sup> ..... **A63F 9/08**

(52) **U.S. Cl.** ..... **273/157 R**

(58) **Field of Search** ..... 273/157 R, 156,  
273/153 R, 160

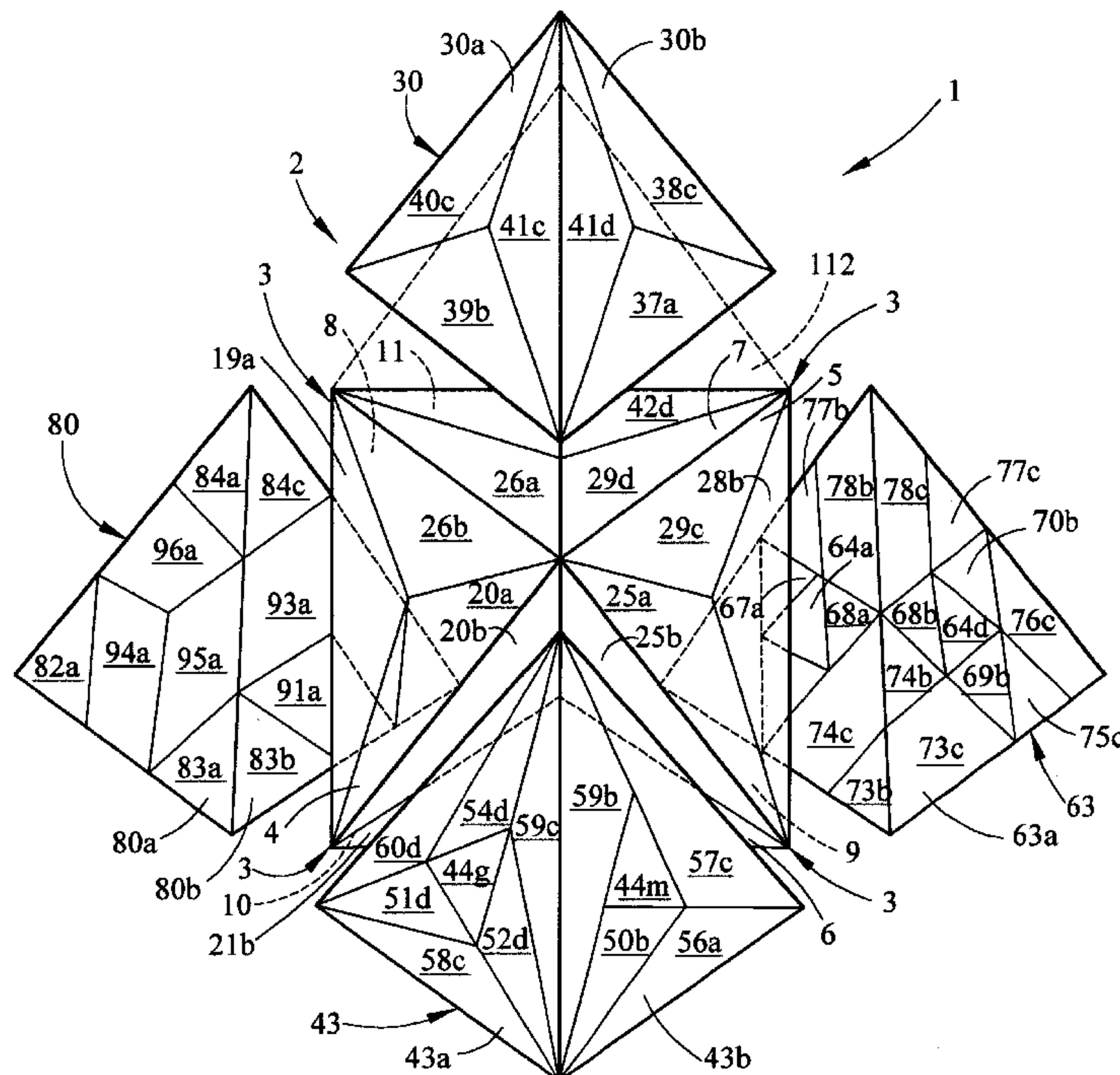
Multi-polyhedral puzzles characterized by four tetrahedra  
and one octahedron which are divided into different sets of  
multiple polyhedron blocks having various configurations,  
each block having multiple faces and each face being one of  
several colors. In a preferred embodiment the polyhedron  
blocks of each octahedron or tetrahedron set are fitted  
together in a corresponding transparent case to form the  
octahedron or tetrahedron, according to one of three levels  
of difficulty. At the most advanced level of difficulty in  
assembling each octahedron and tetrahedron, the polyhedron  
blocks of each set are fitted together such that abutting faces  
of adjacent polyhedron blocks match in color and a pre-  
scribed color pattern is formed on the respective faces of the  
assembled octahedron or tetrahedron. At an intermediate  
level of difficulty, the polyhedron blocks are fitted together  
to form the prescribed color pattern on the faces of the  
assembled octahedron or tetrahedron without regard to  
matching colors of abutting polyhedron block faces. At an  
elementary level of difficulty, the polyhedron blocks are  
fitted together to form the corresponding octahedron or  
tetrahedron without regard to matching colors of abutting  
polyhedron block faces or formation of the prescribed color  
pattern on the faces of the assembled octahedron or tetra-  
hedron. The assembled tetrahedra can be arranged on  
respective faces of the assembled octahedron to form a large  
tetrahedron, for packaging or storage purposes.

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**9 Claims, 17 Drawing Sheets**



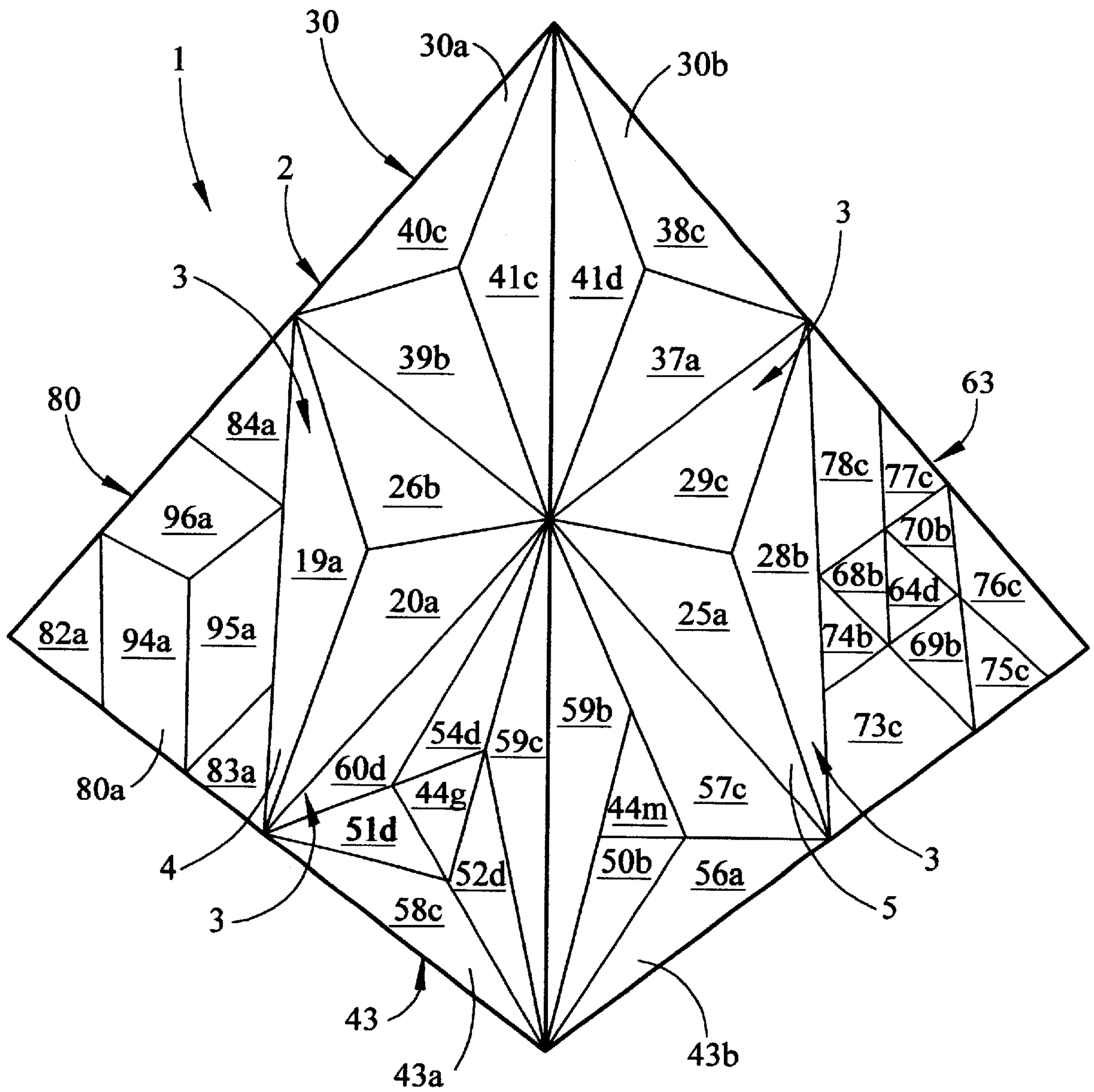


FIG. 1

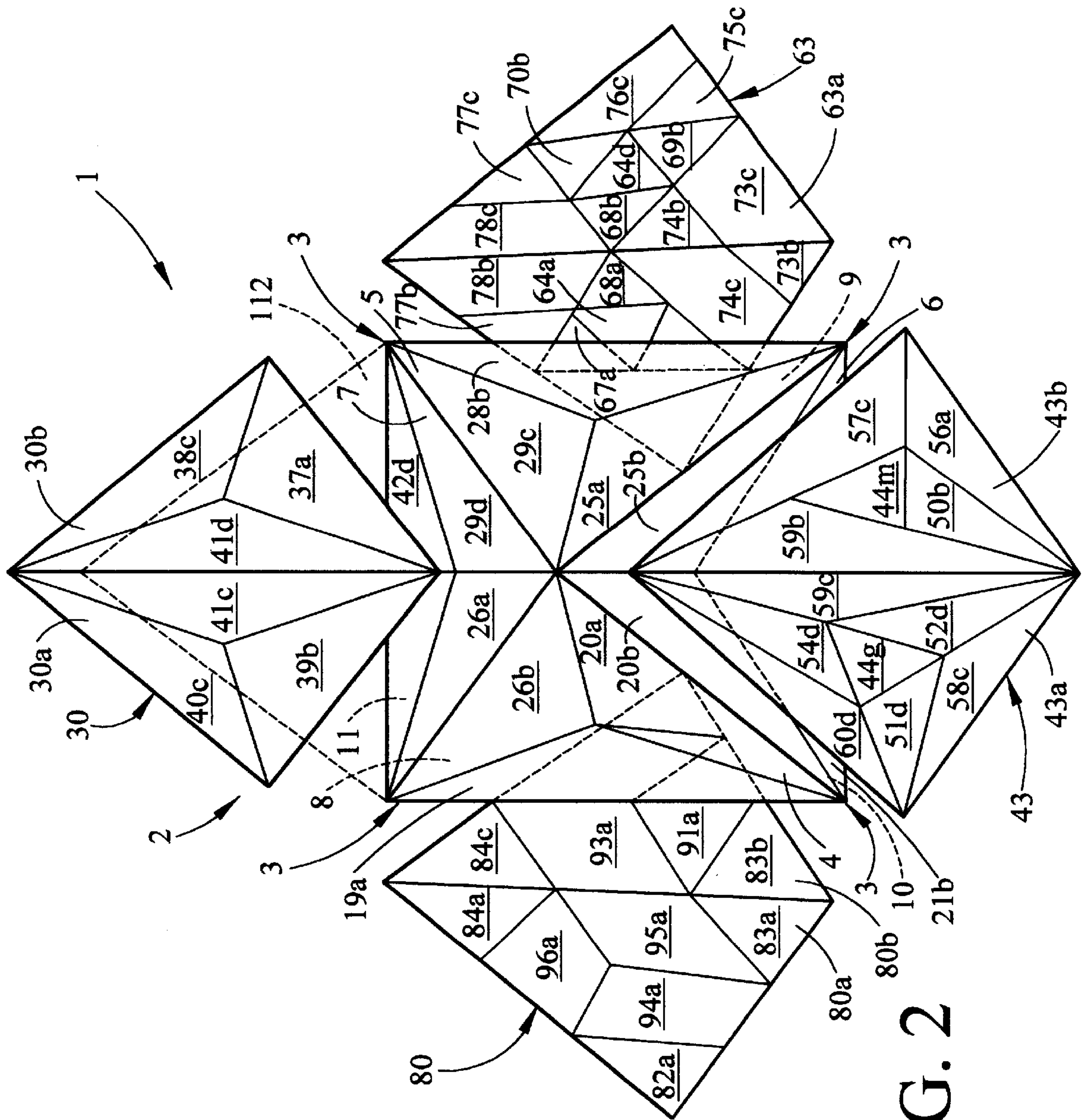


FIG. 2



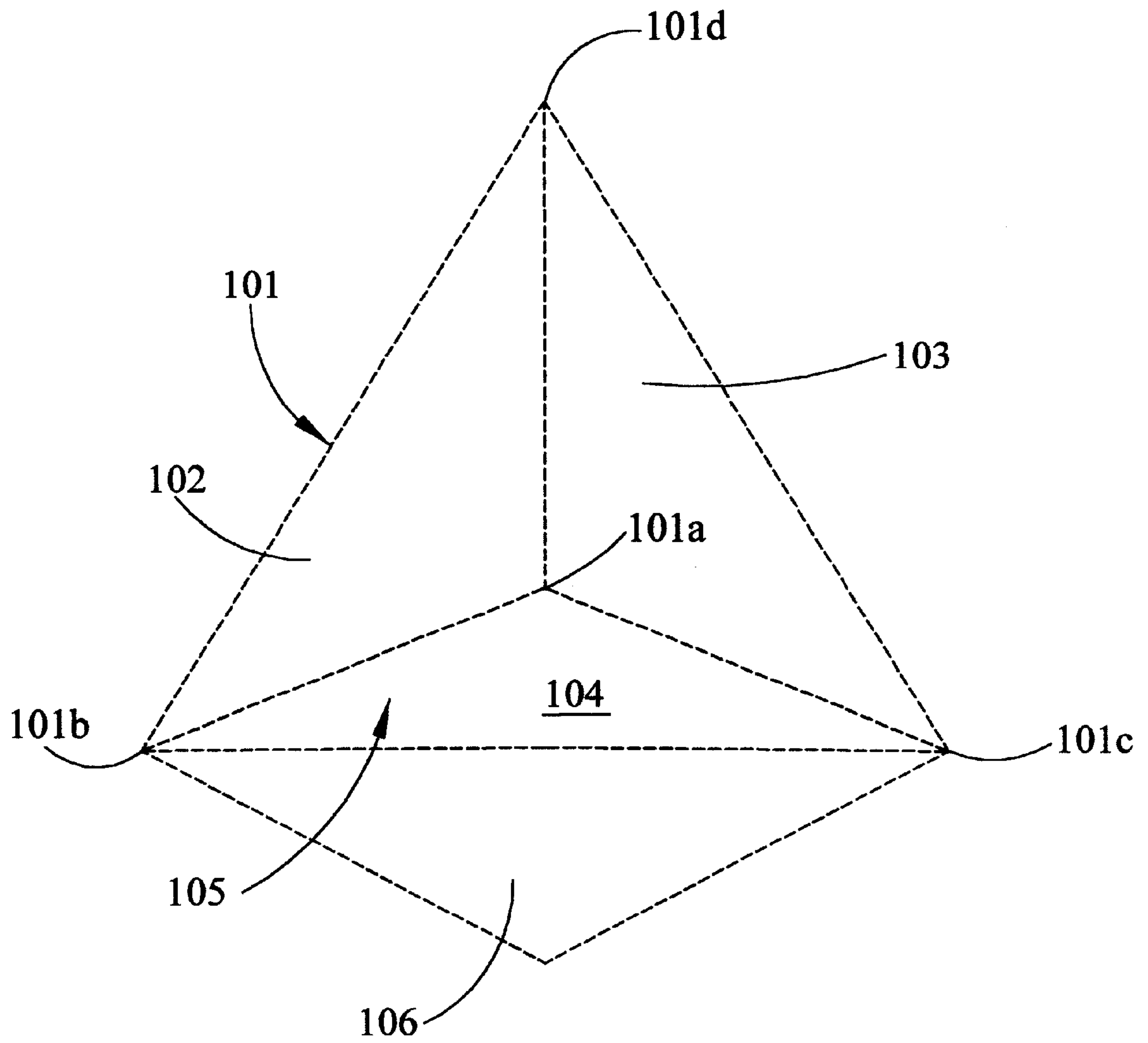


FIG. 3

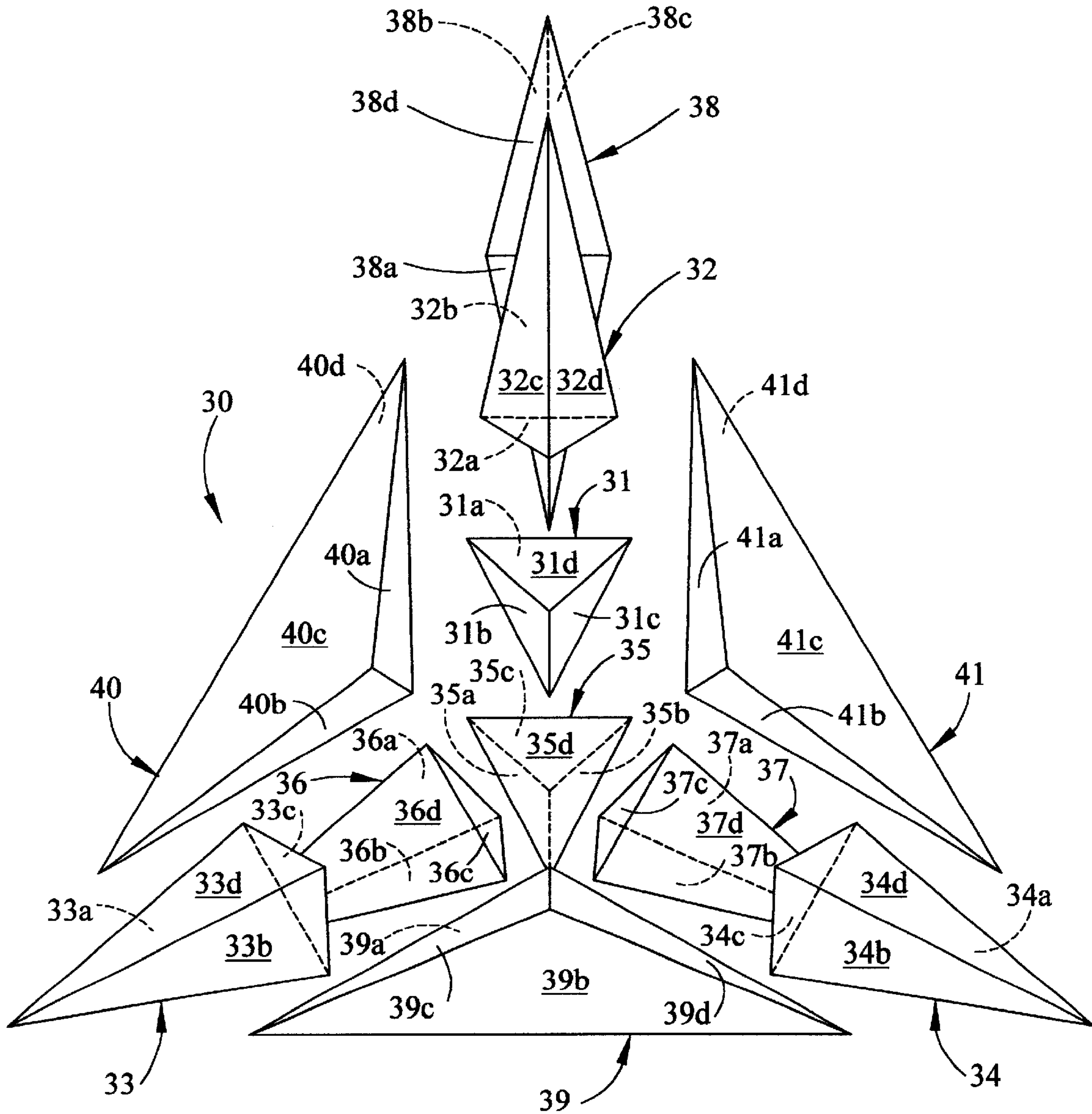


FIG. 4

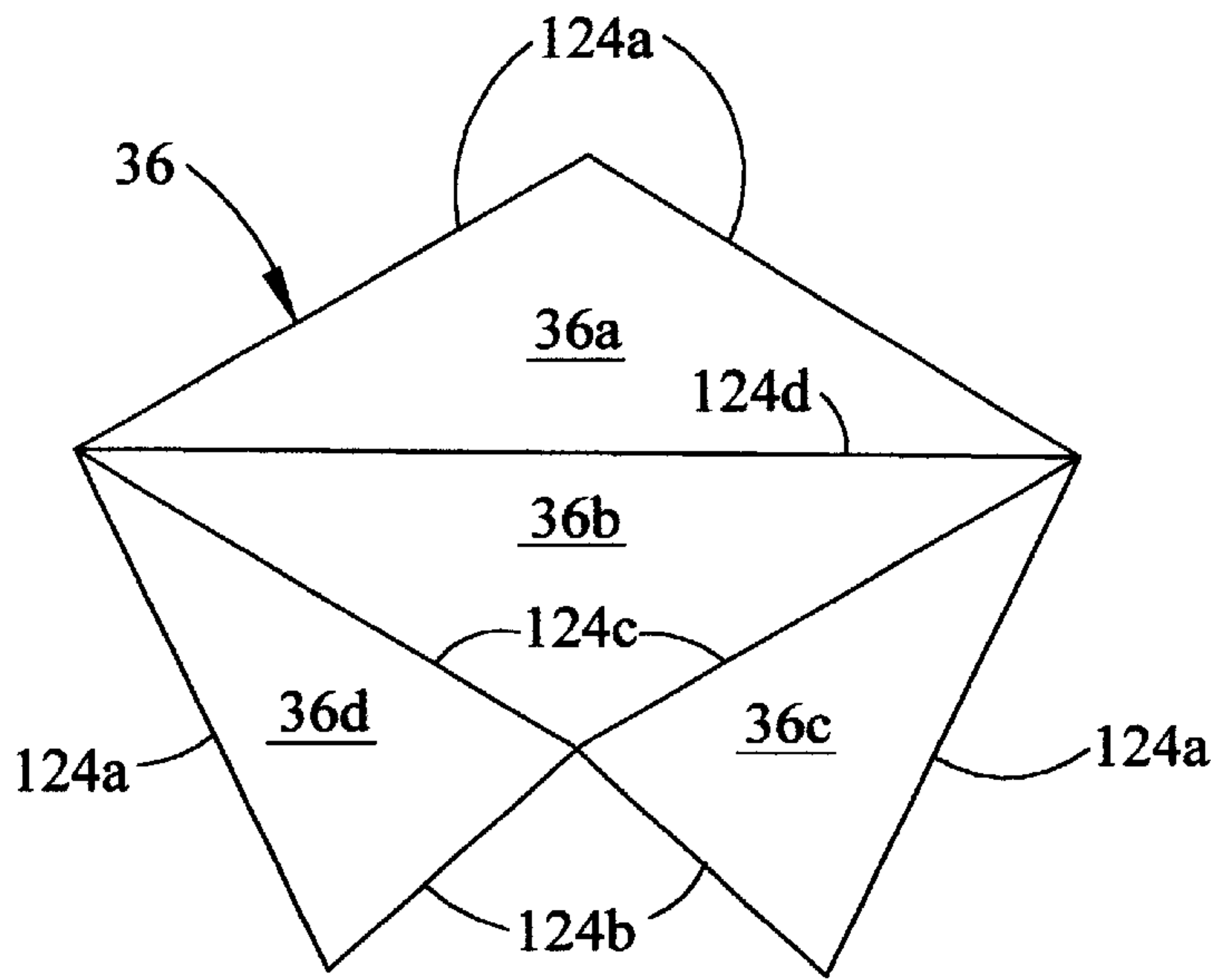


FIG. 4A

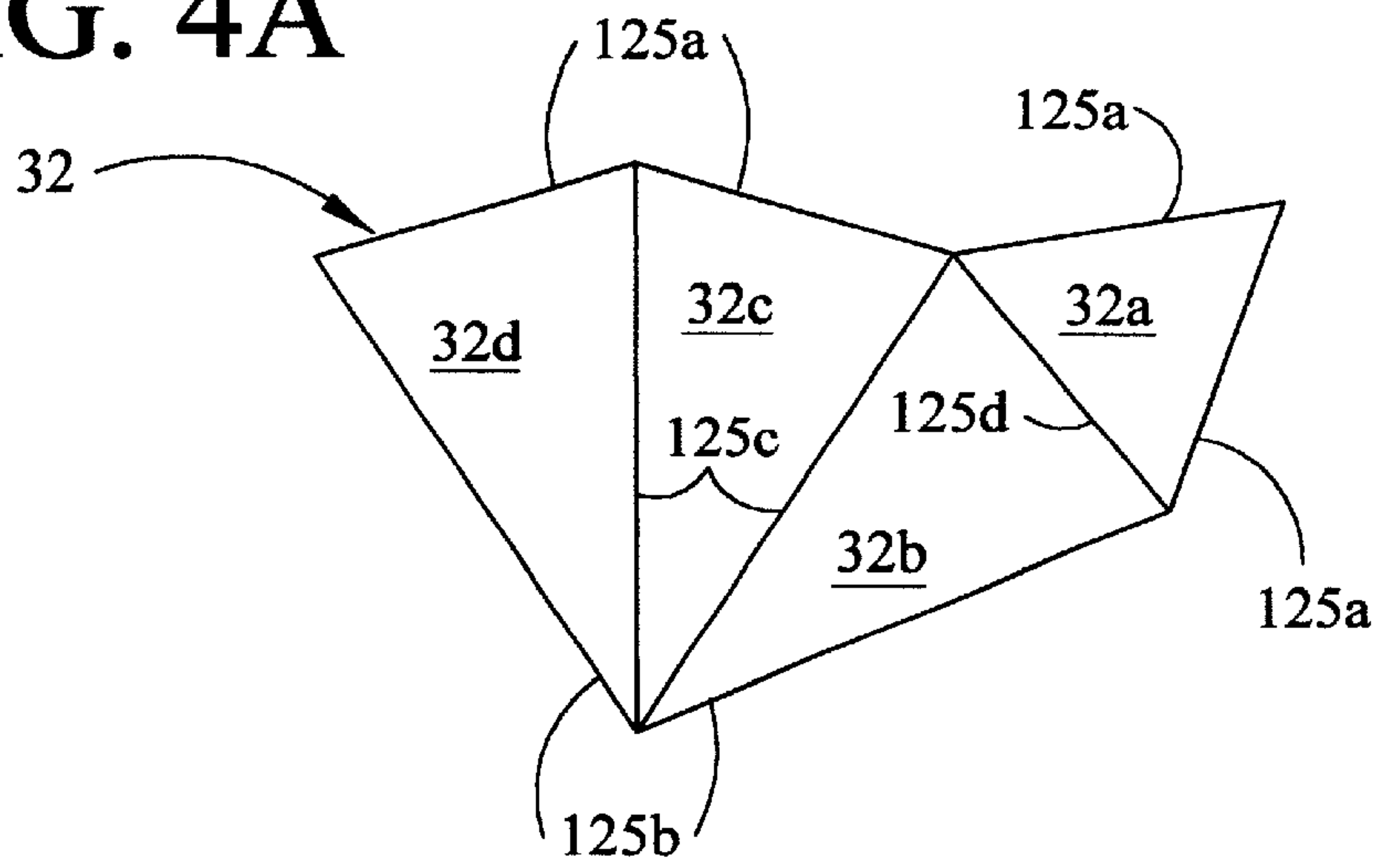


FIG. 4B

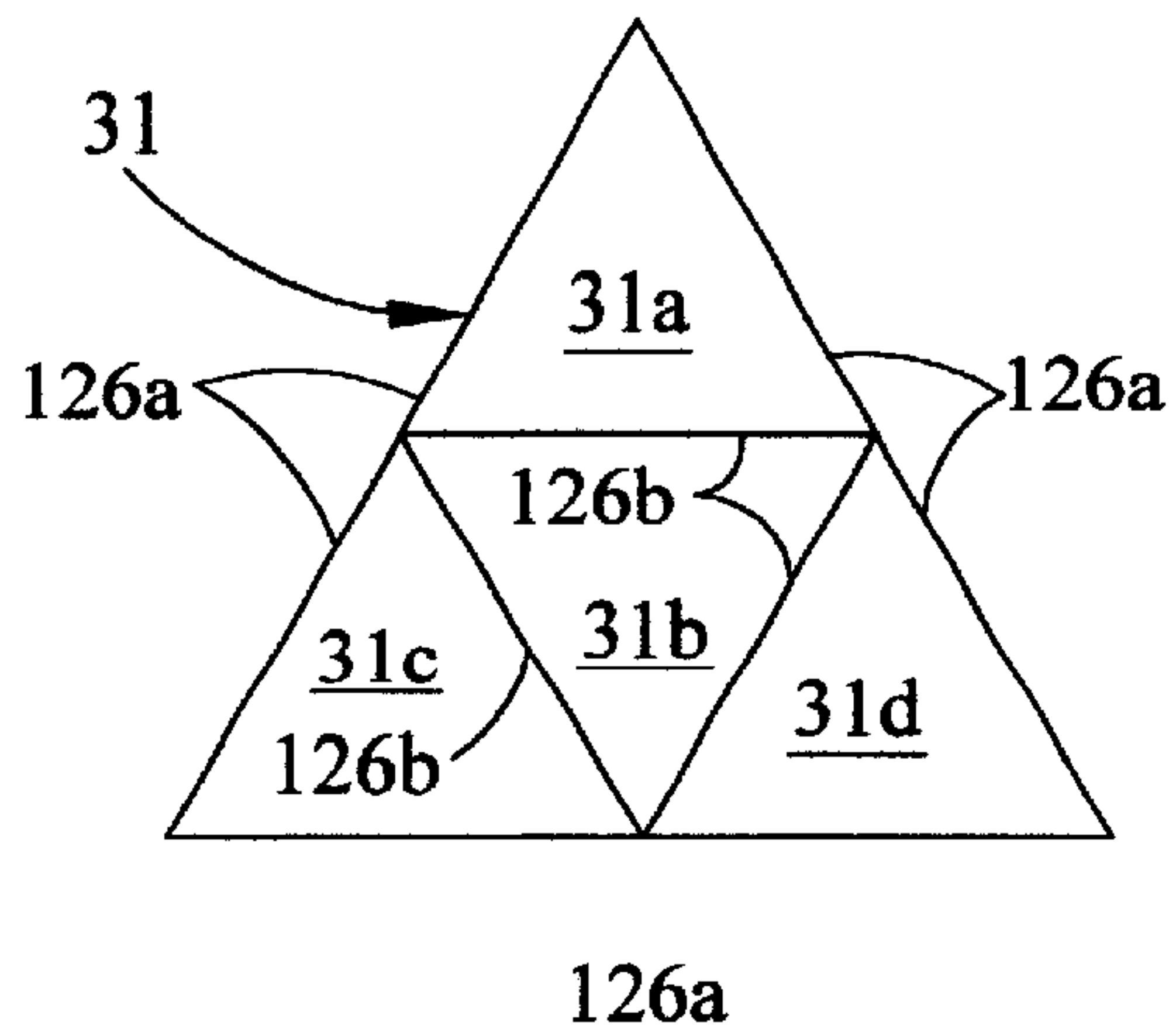


FIG. 4C

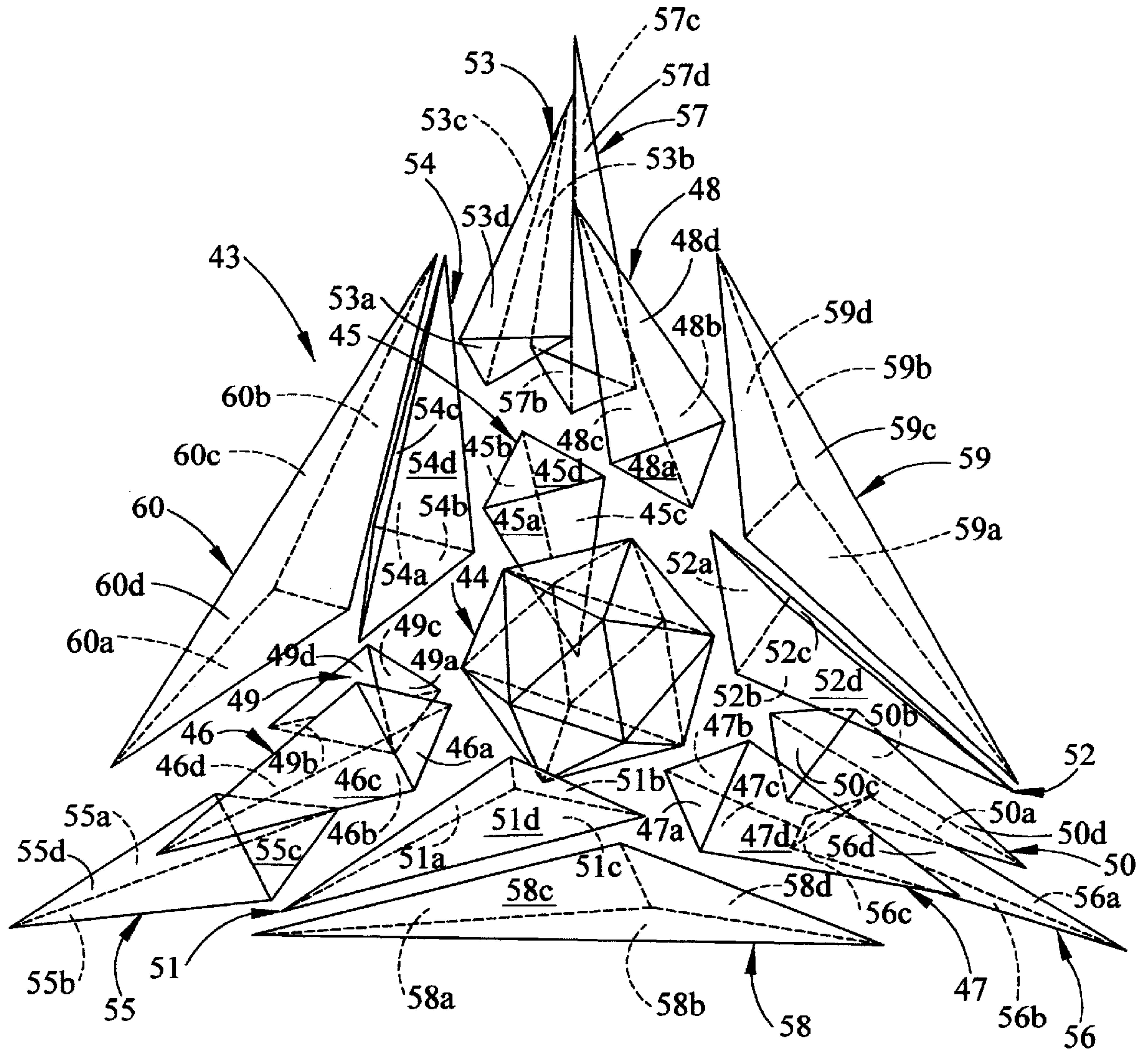


FIG. 5

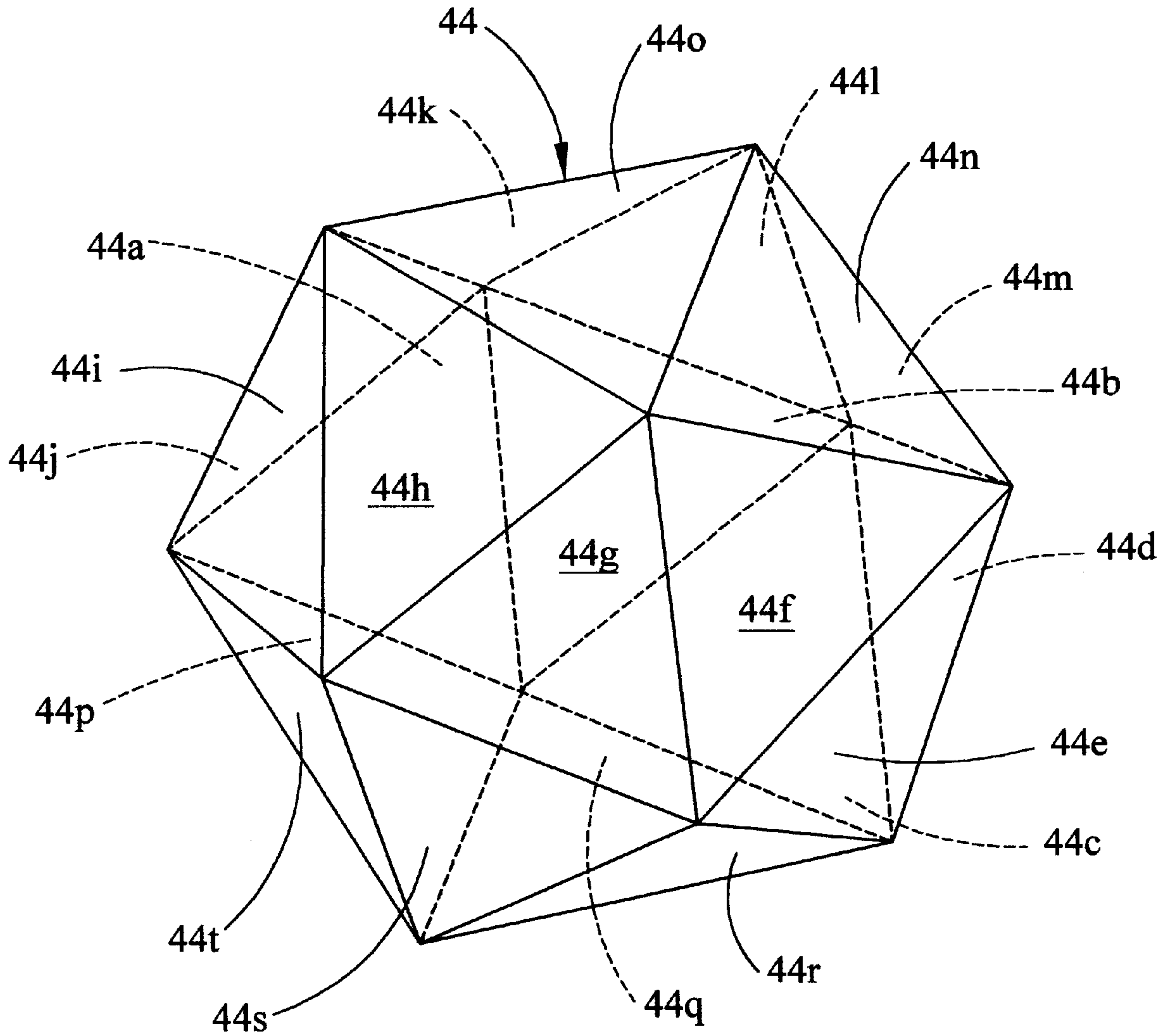


FIG. 5A



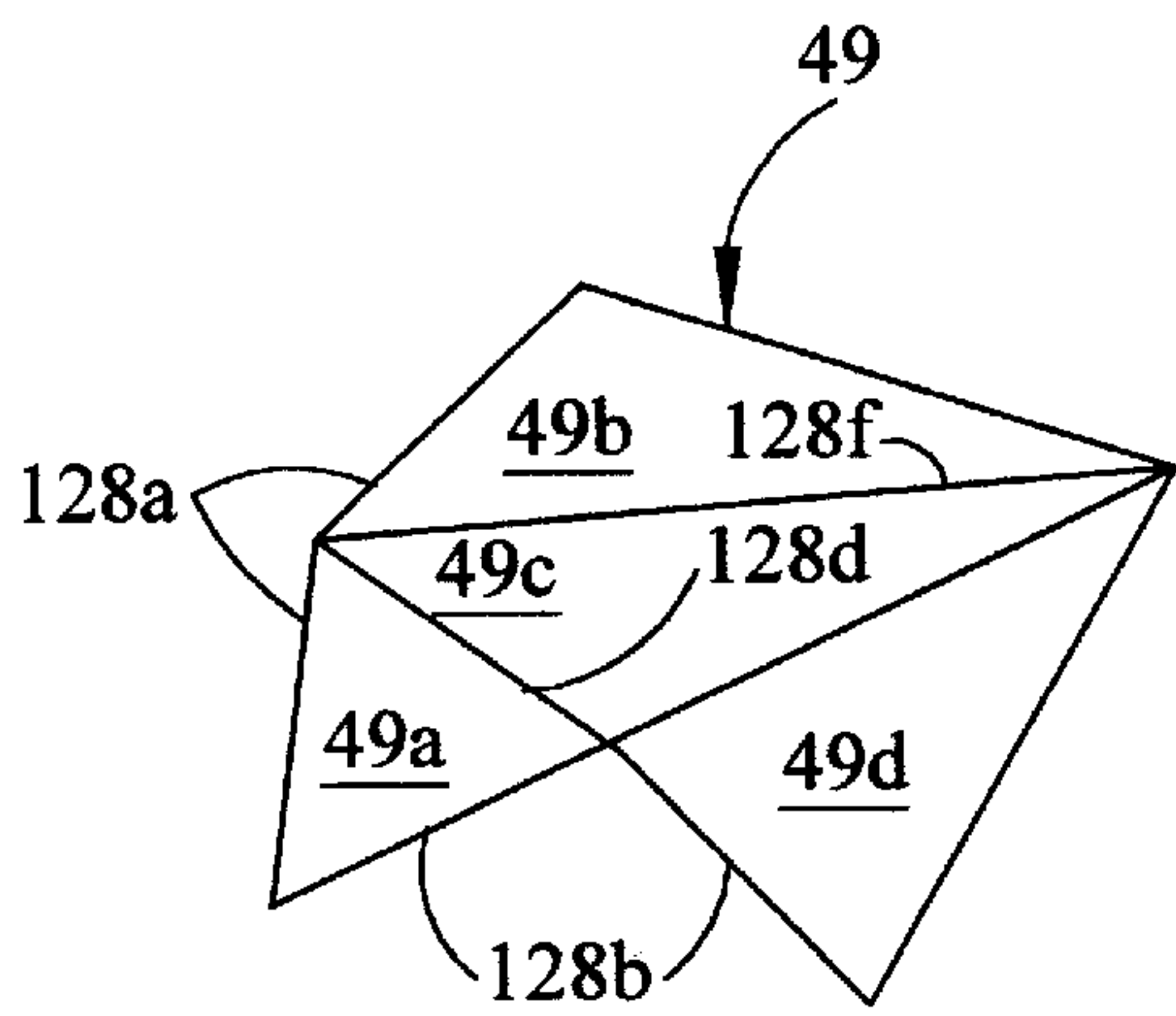


FIG. 5B

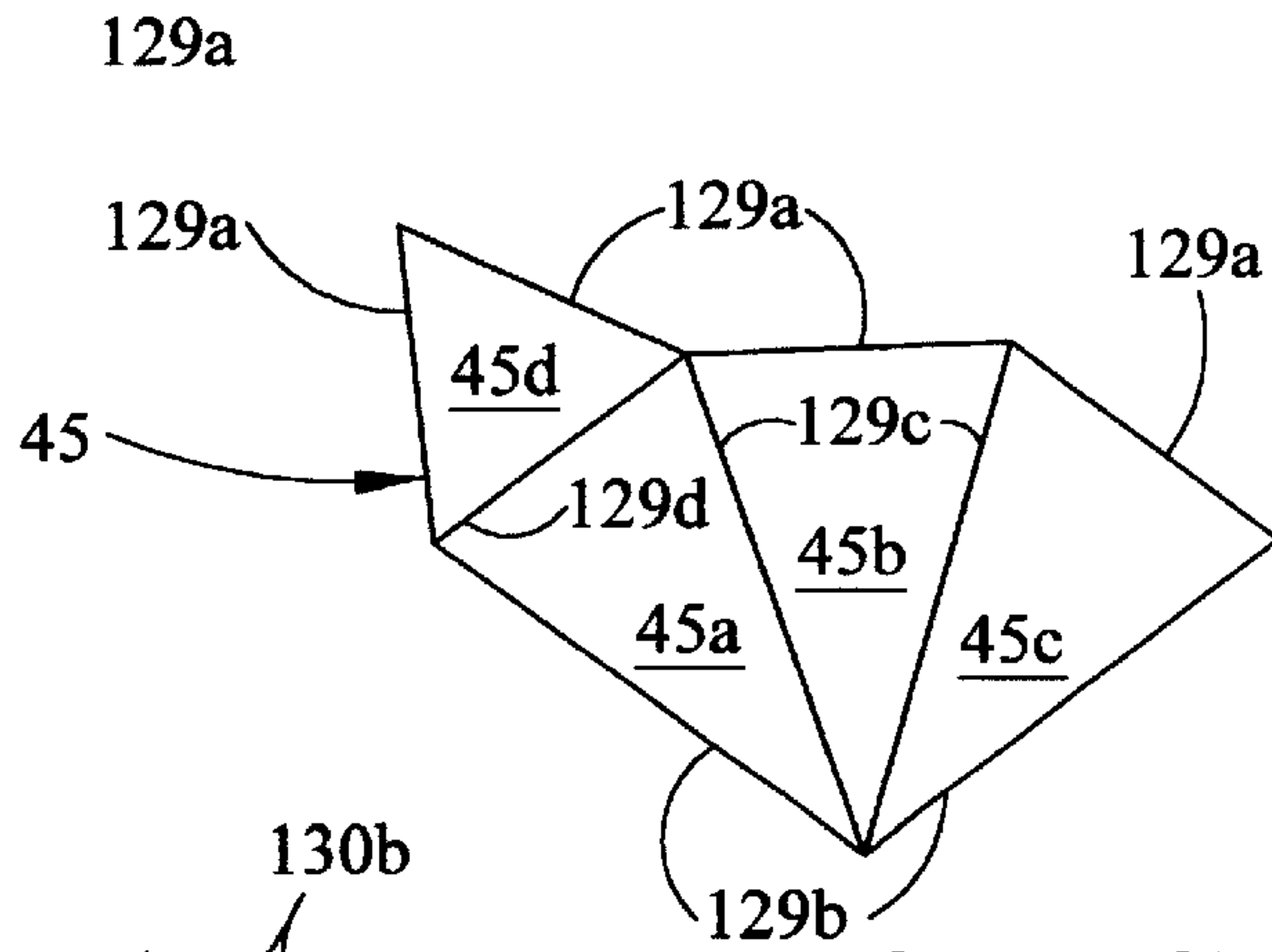


FIG. 5C

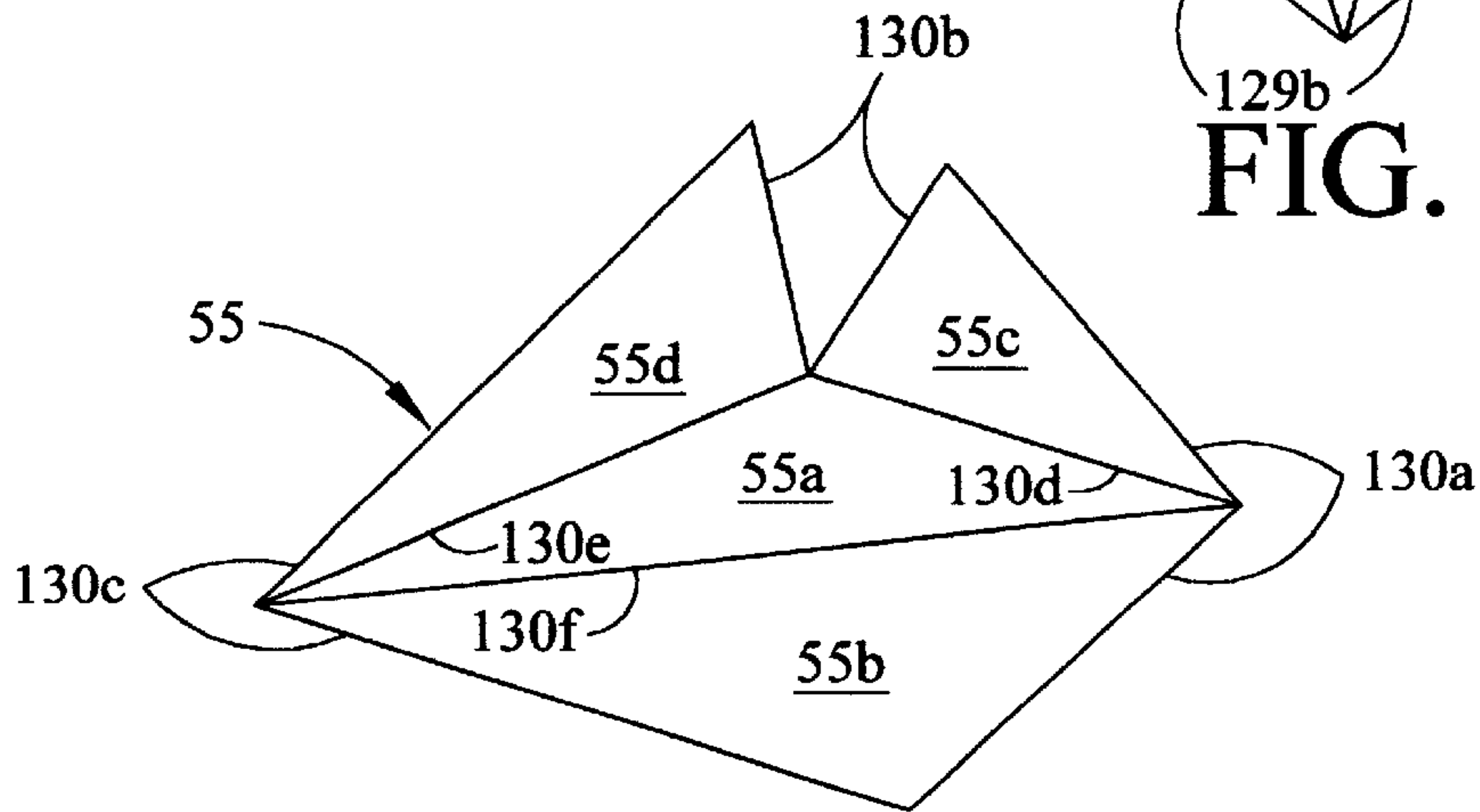


FIG. 5D

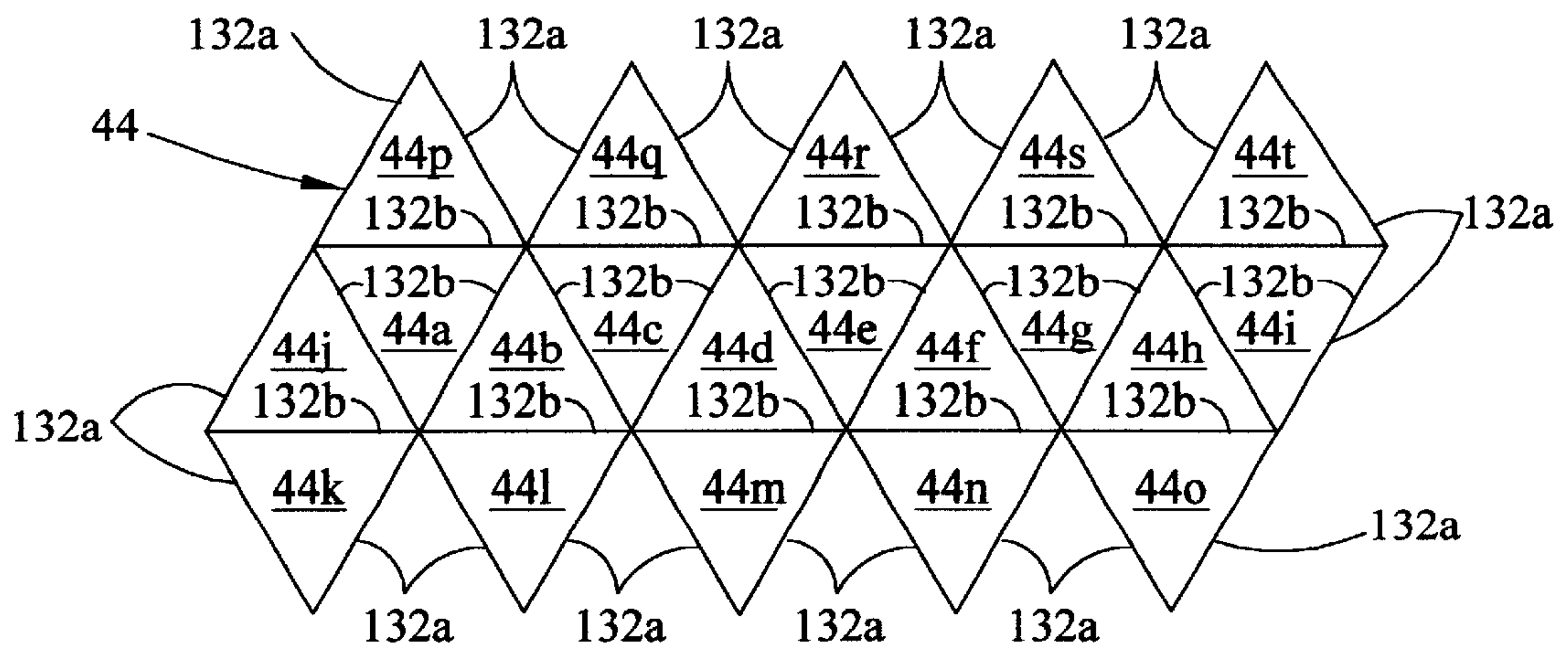


FIG. 5E

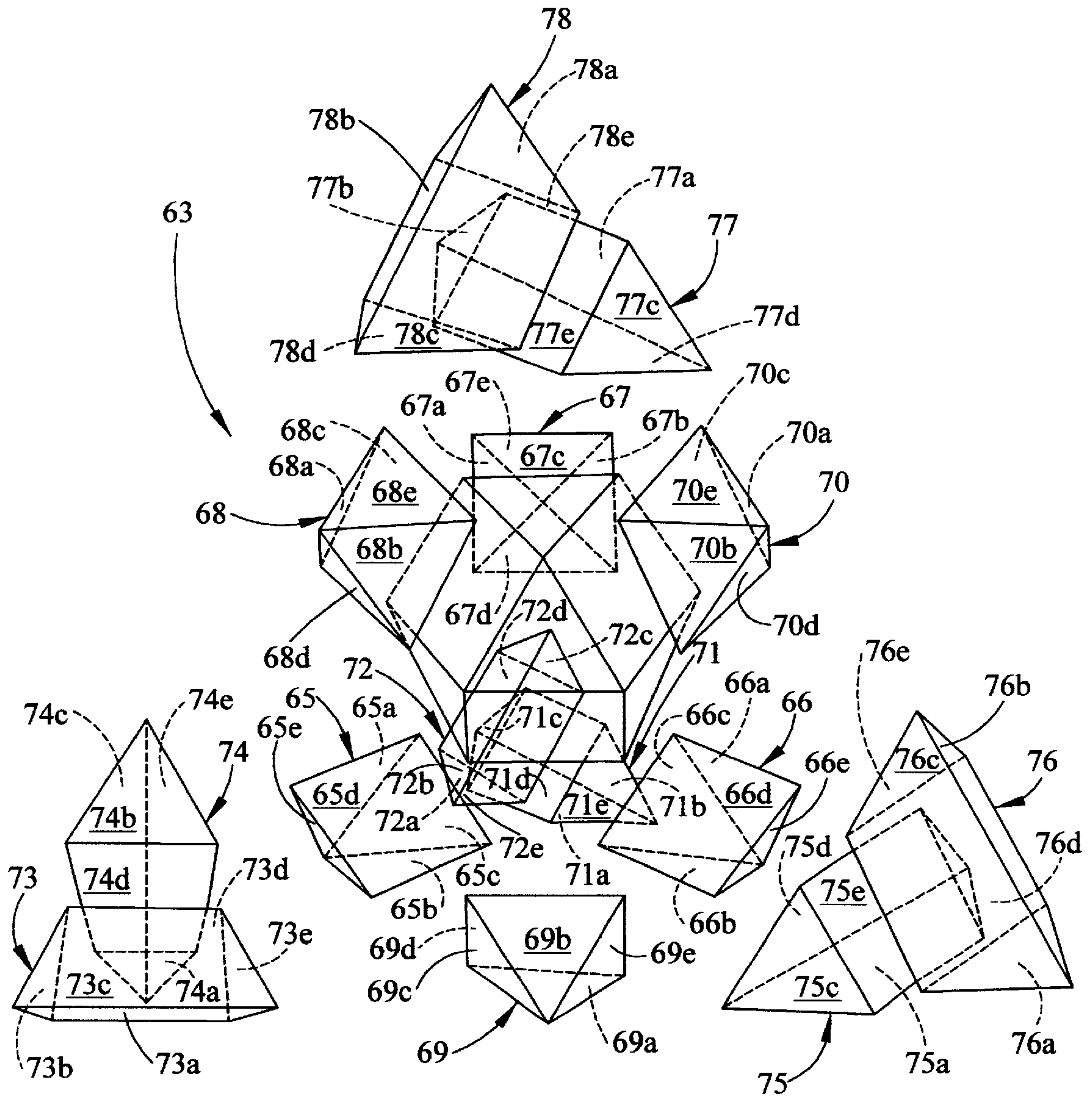
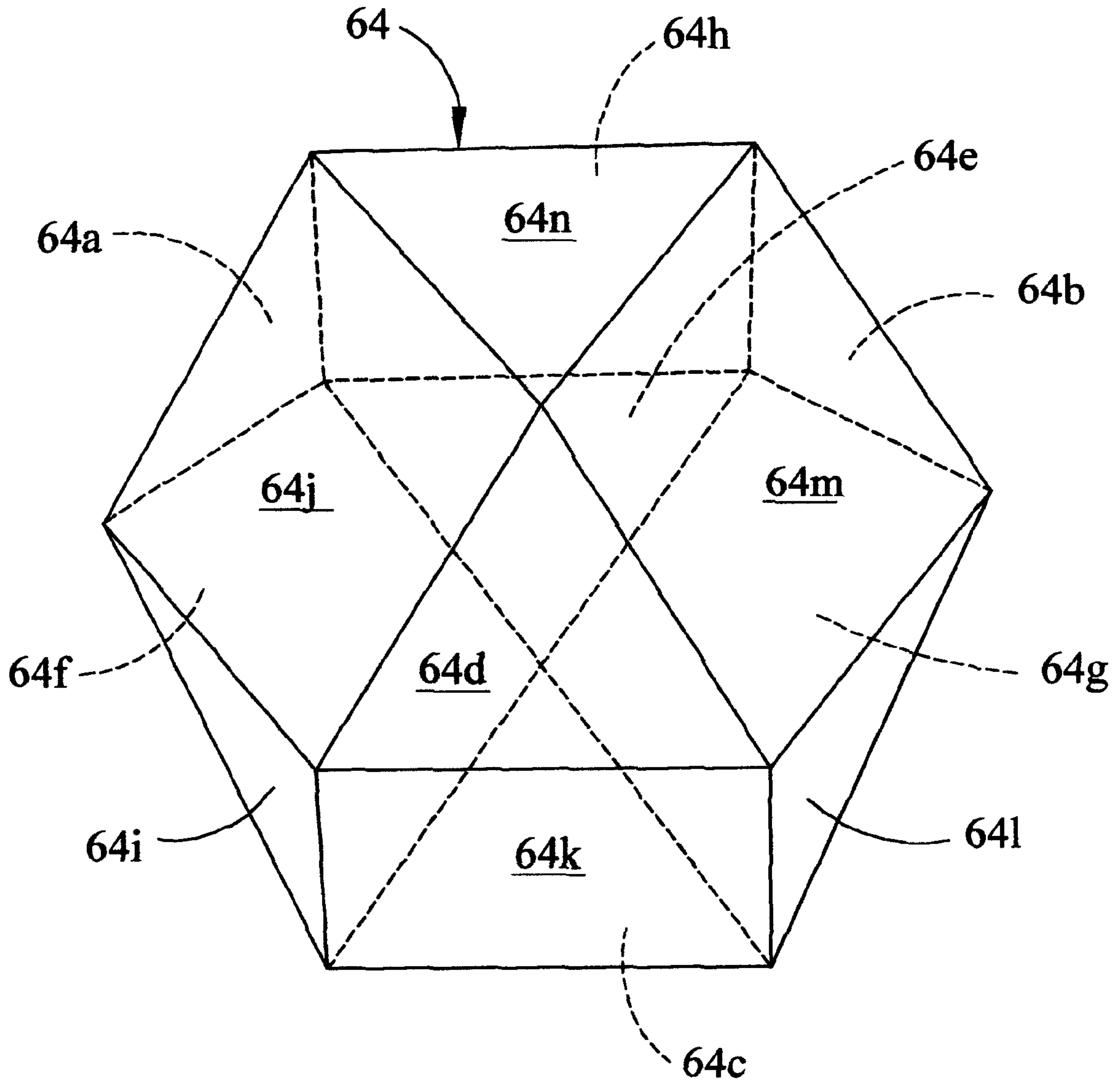


FIG. 6



**FIG. 6A**

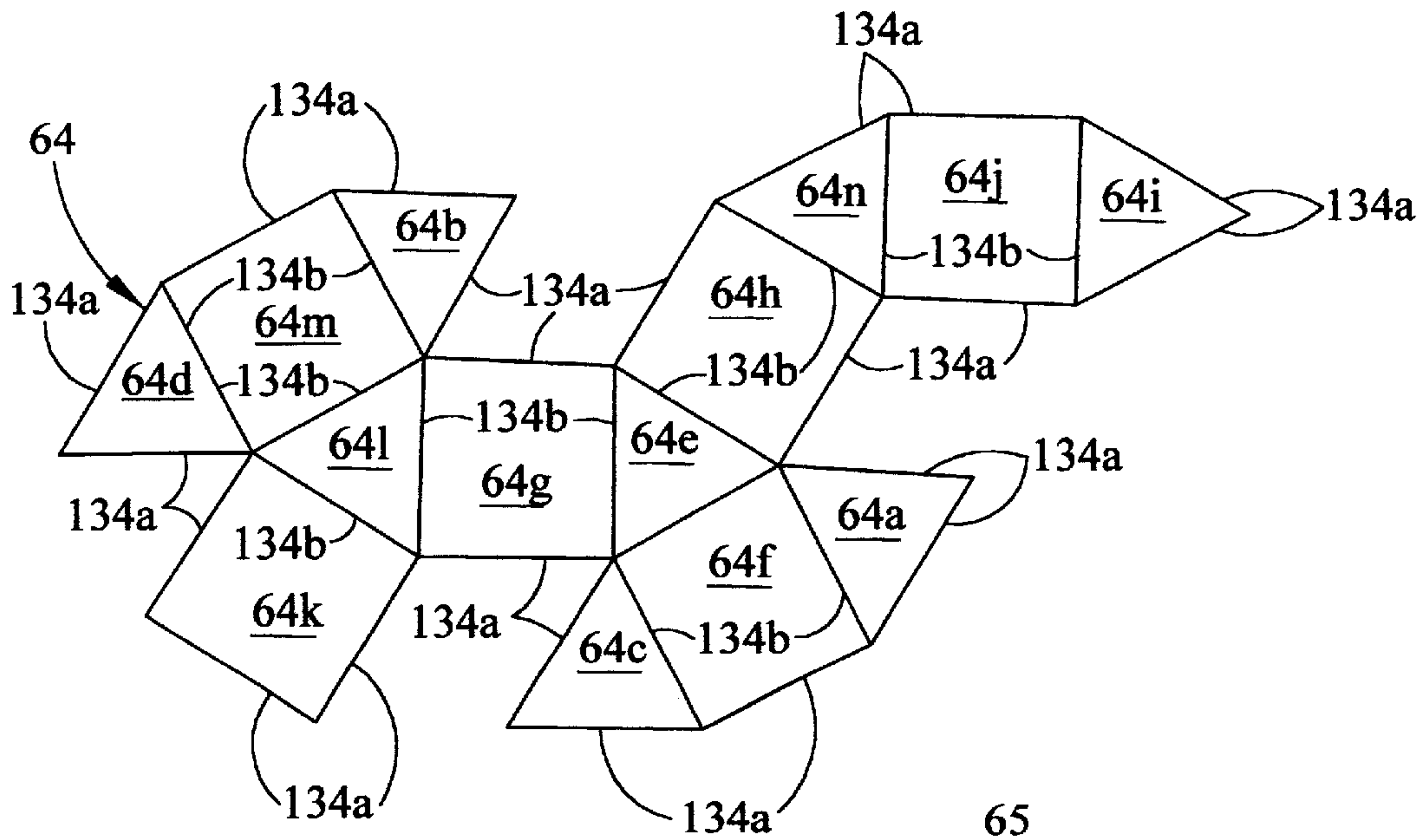


FIG. 6B

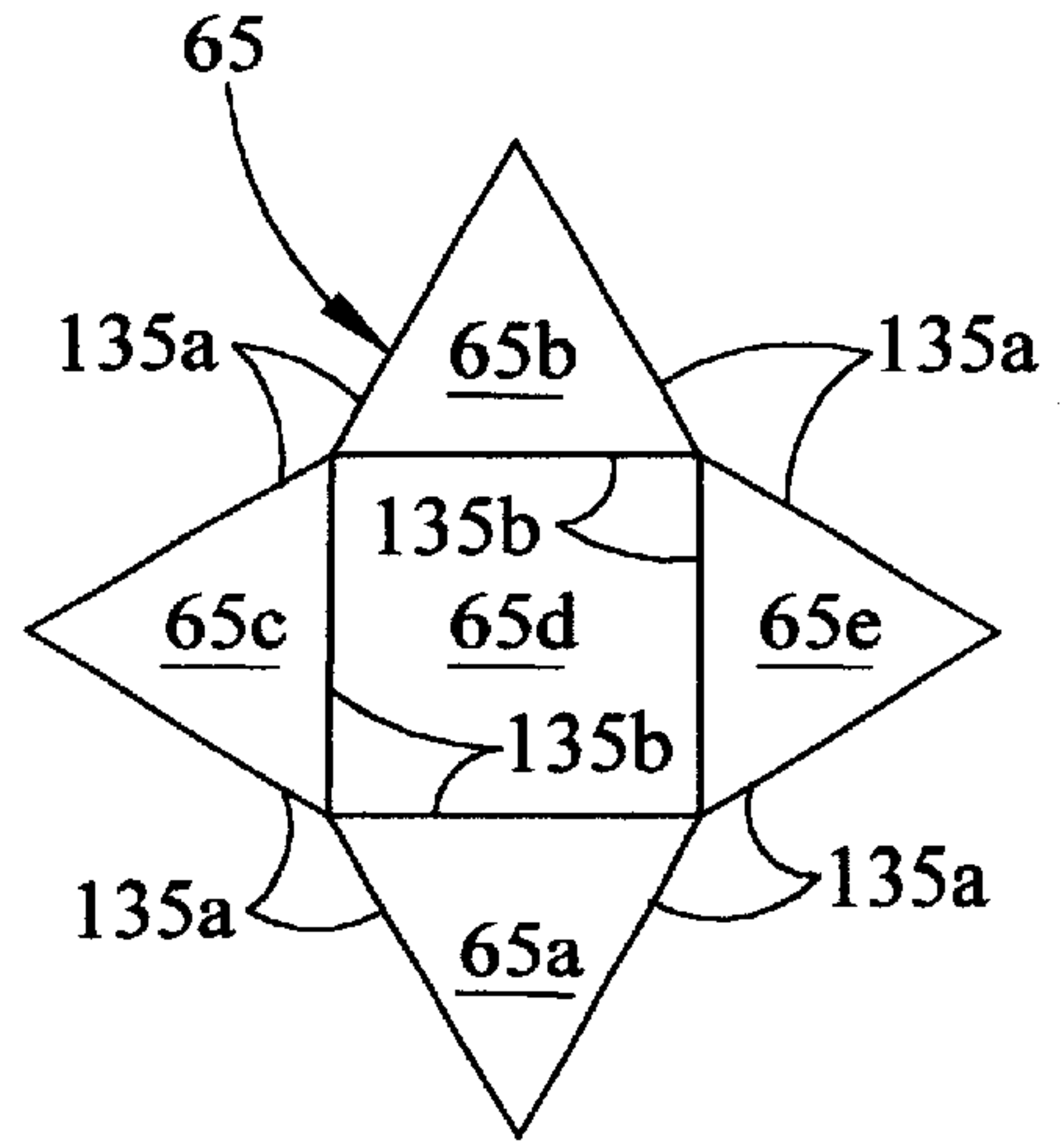


FIG. 6C

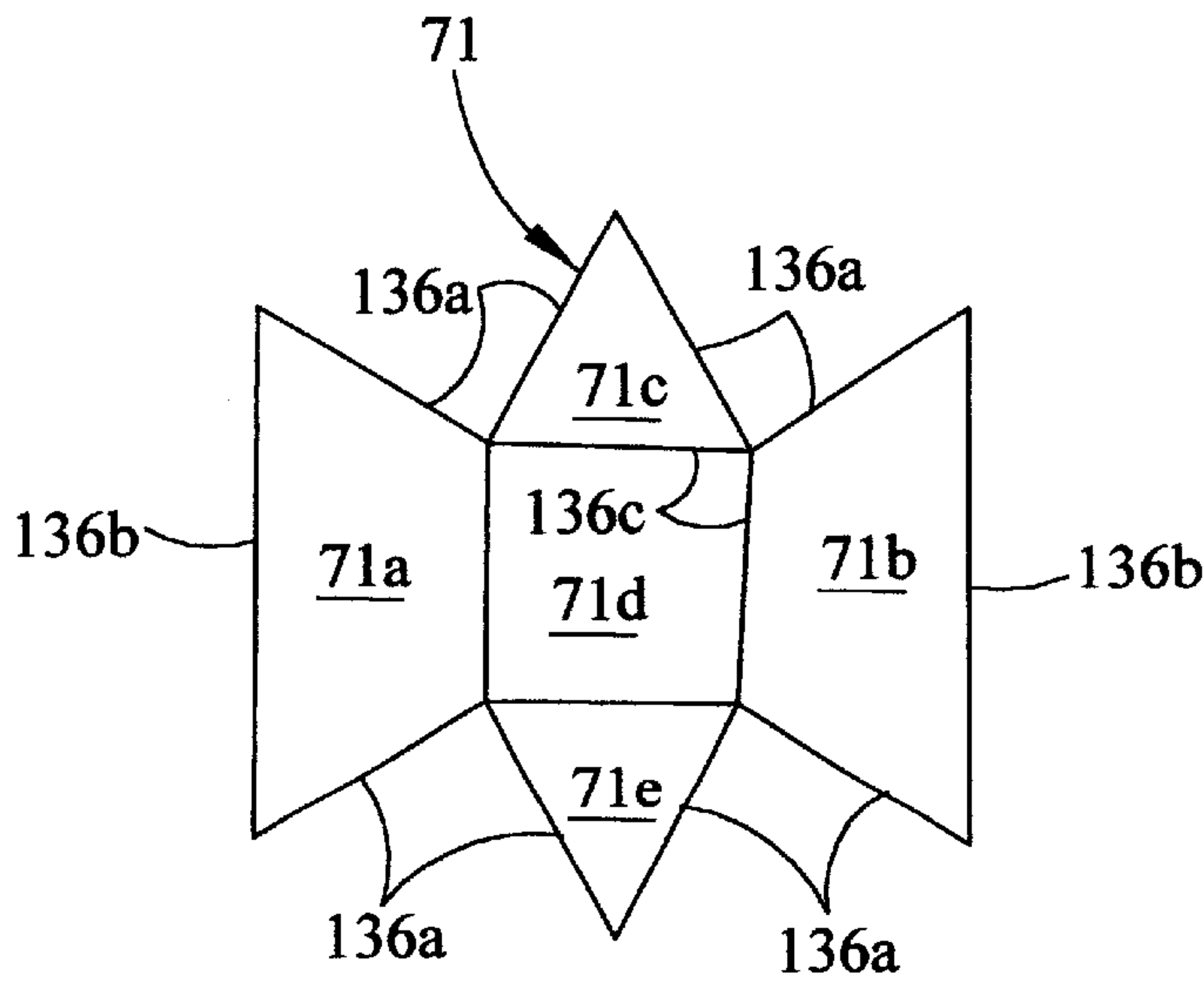


FIG. 6D



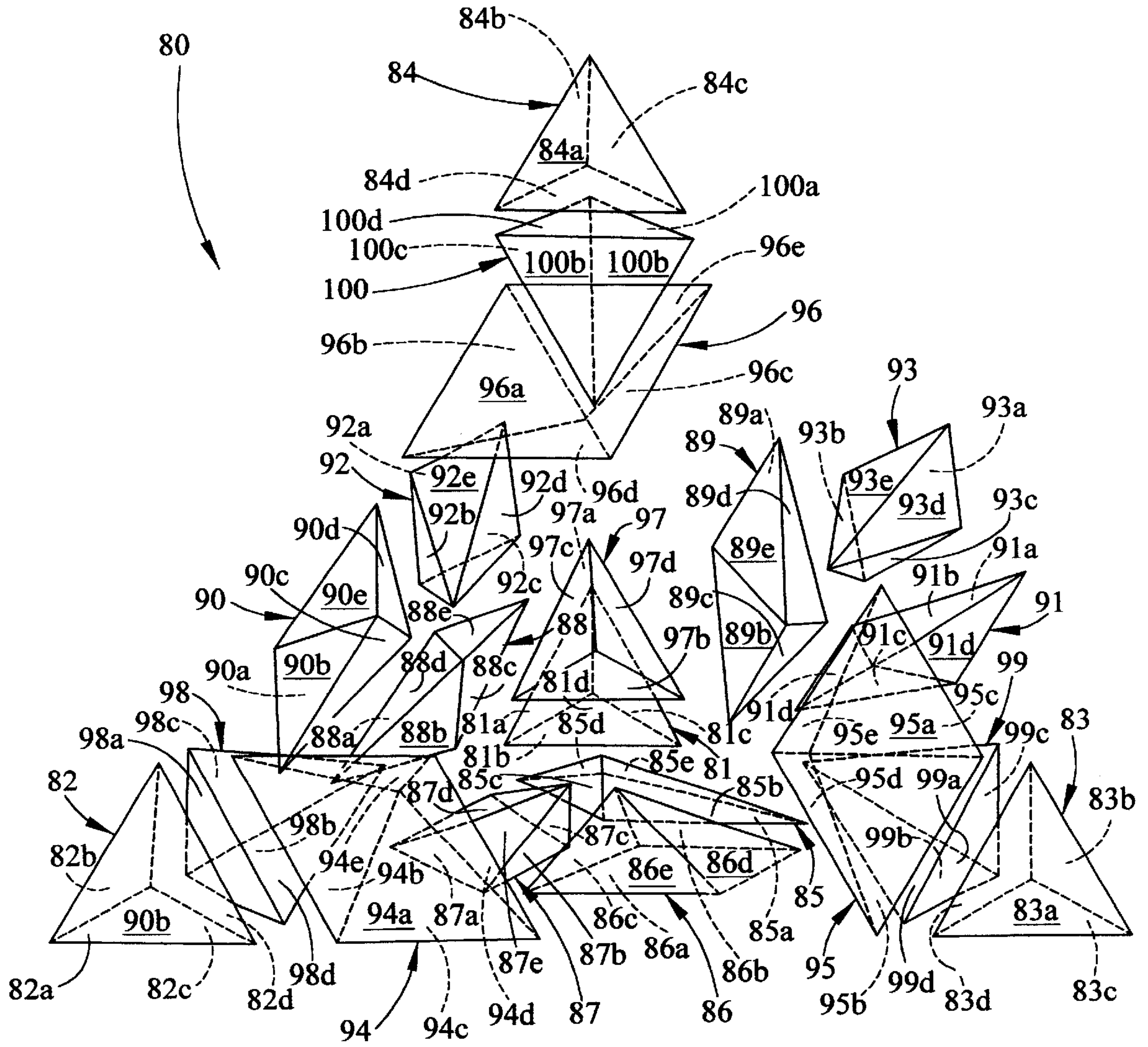


FIG. 7

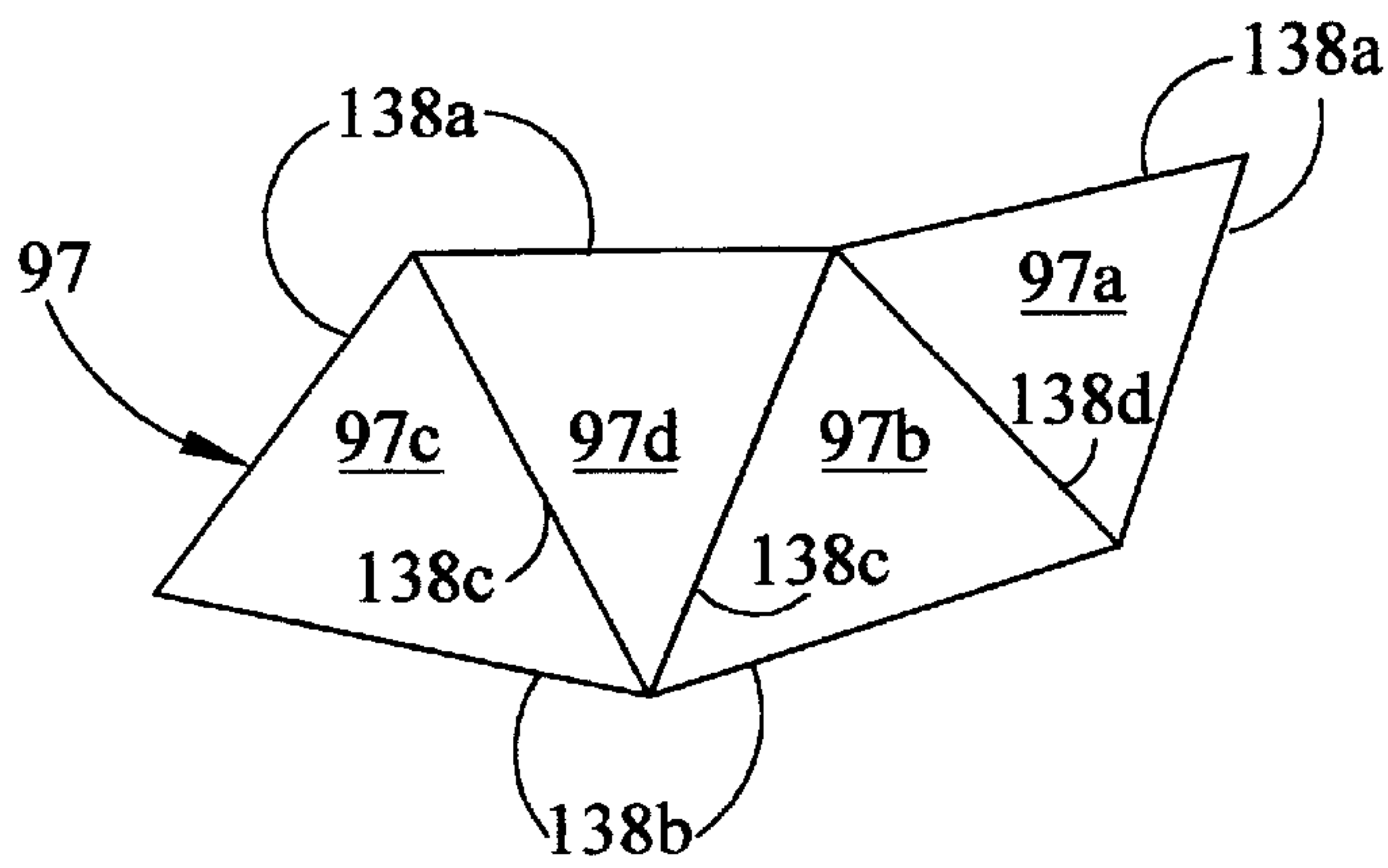


FIG. 7A

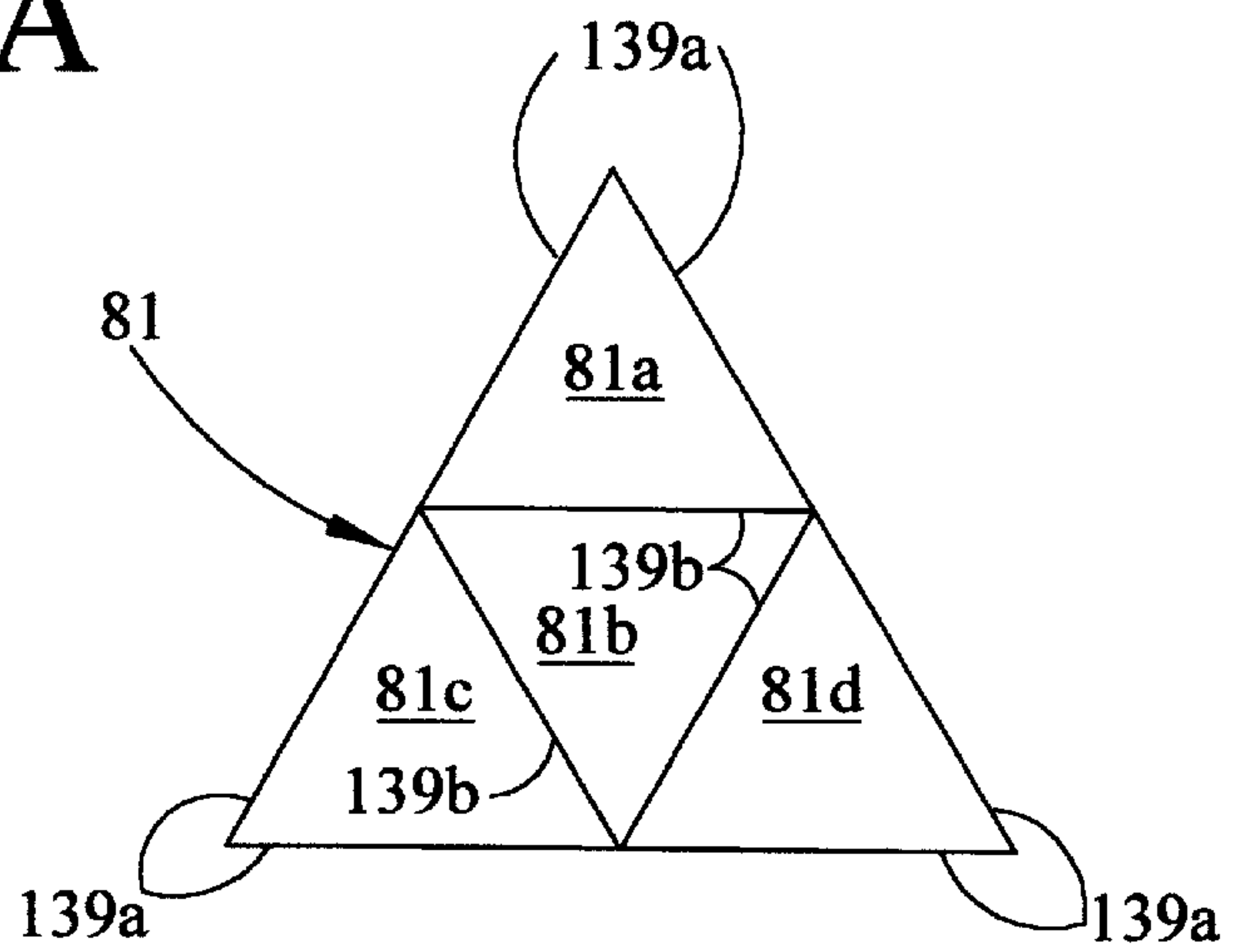


FIG. 7B

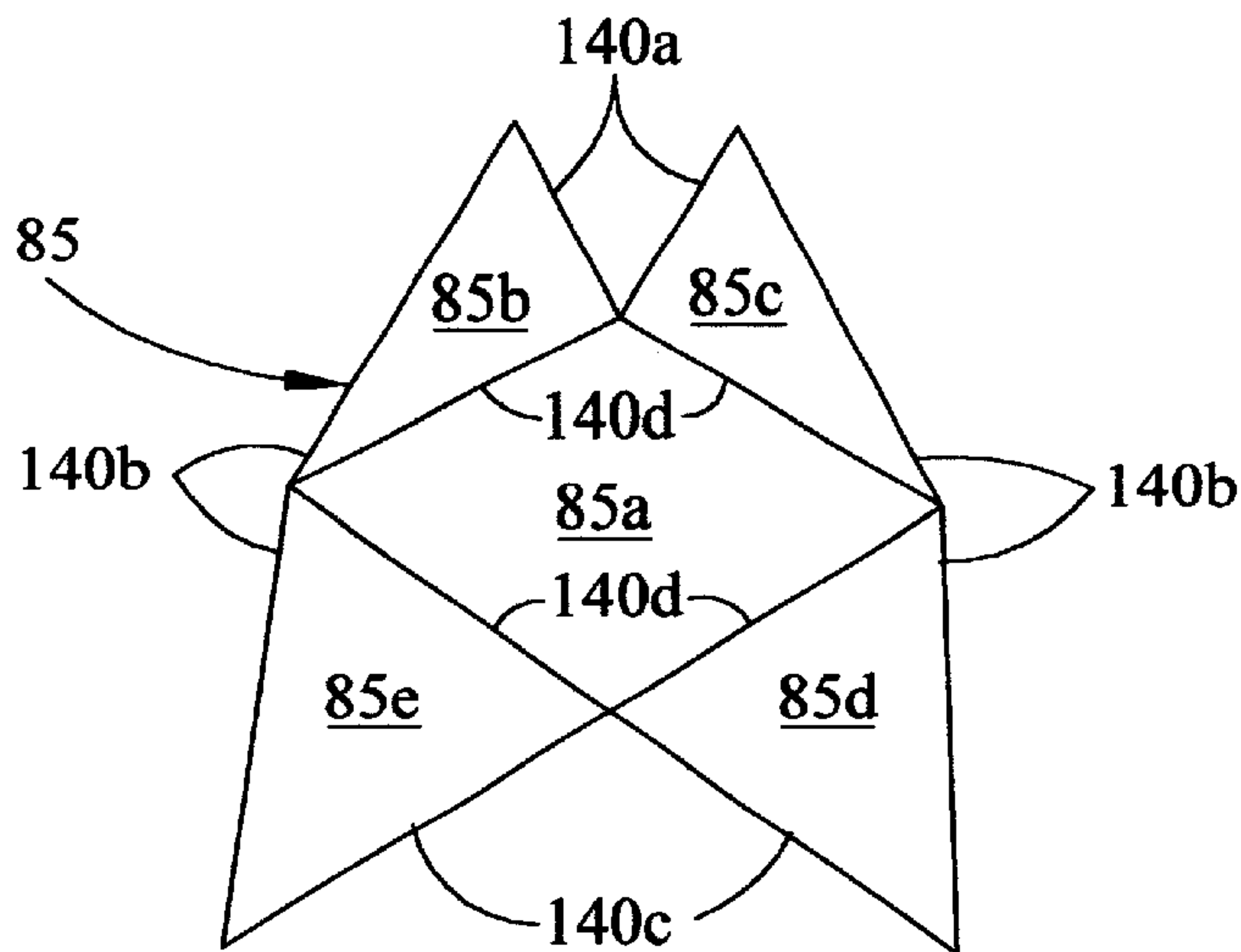


FIG. 7C

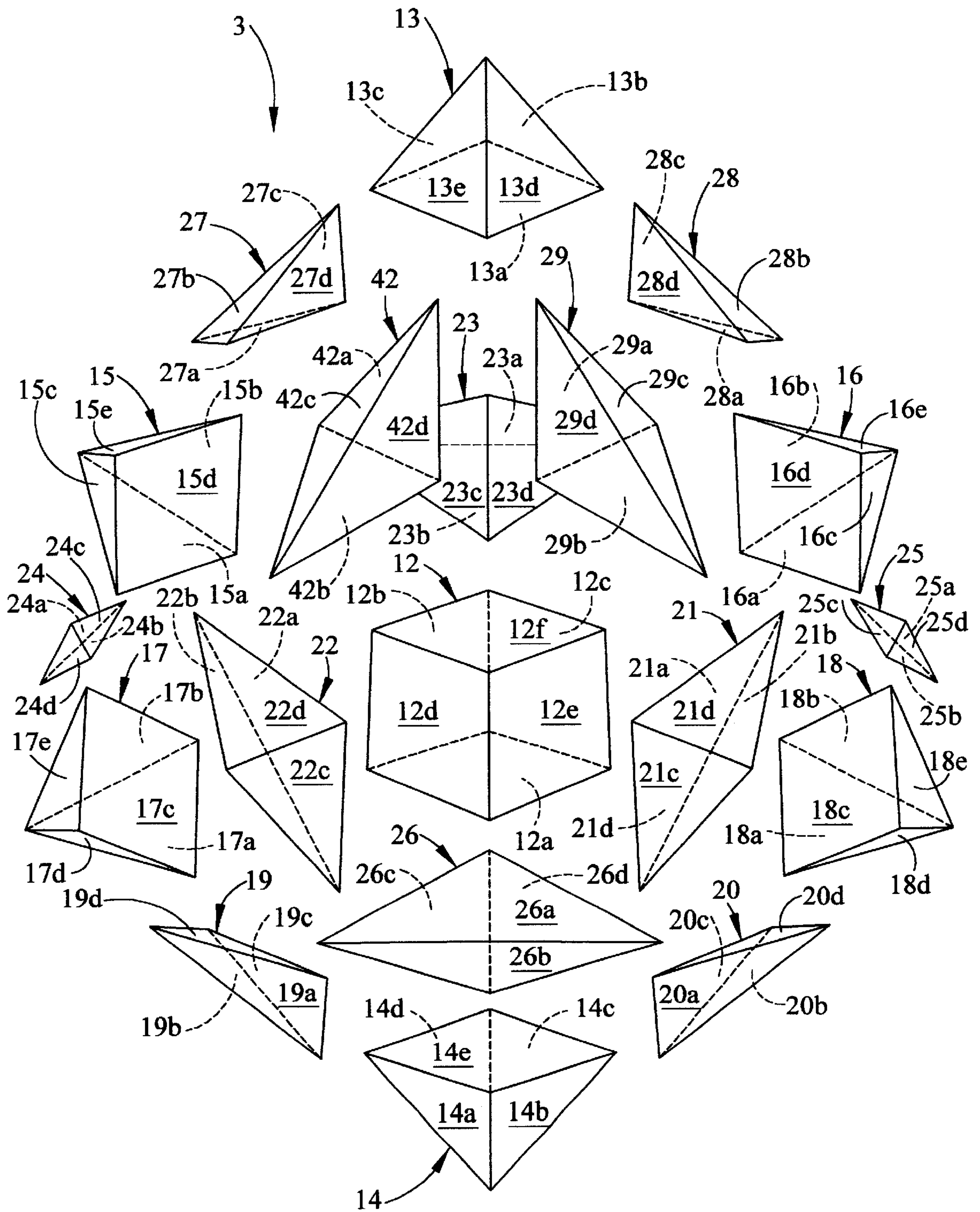


FIG. 8

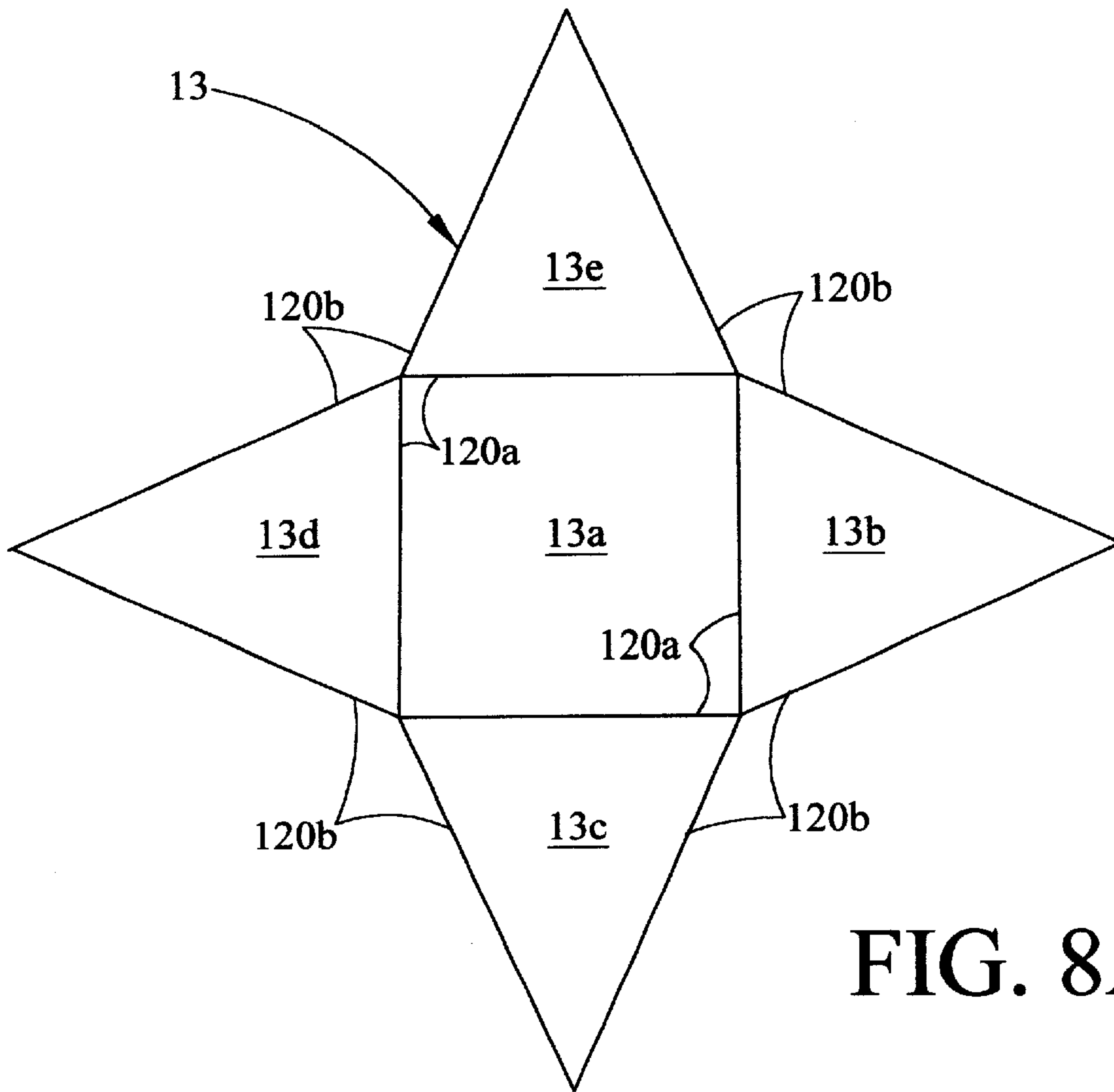


FIG. 8A

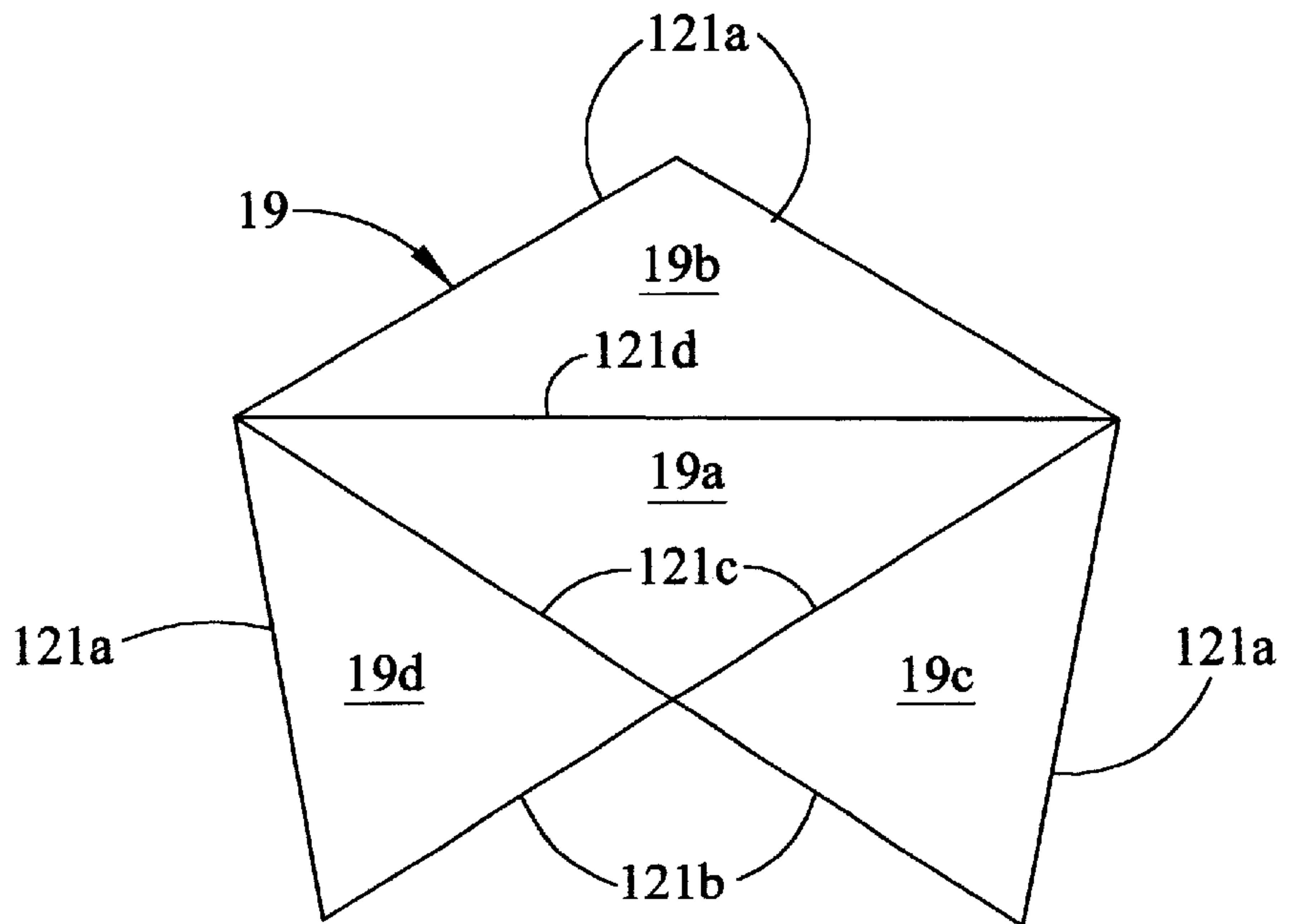


FIG. 8B



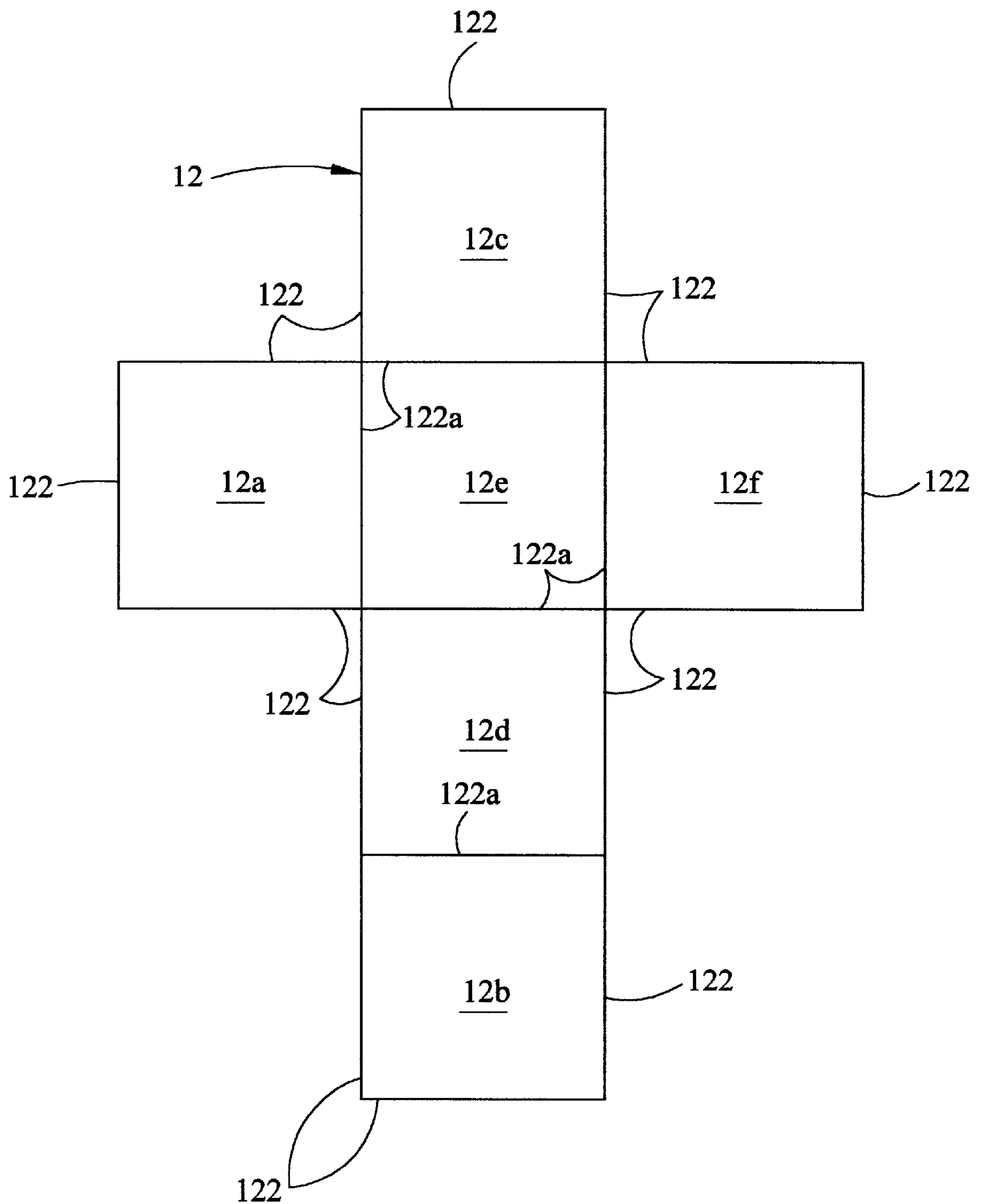


FIG. 8C

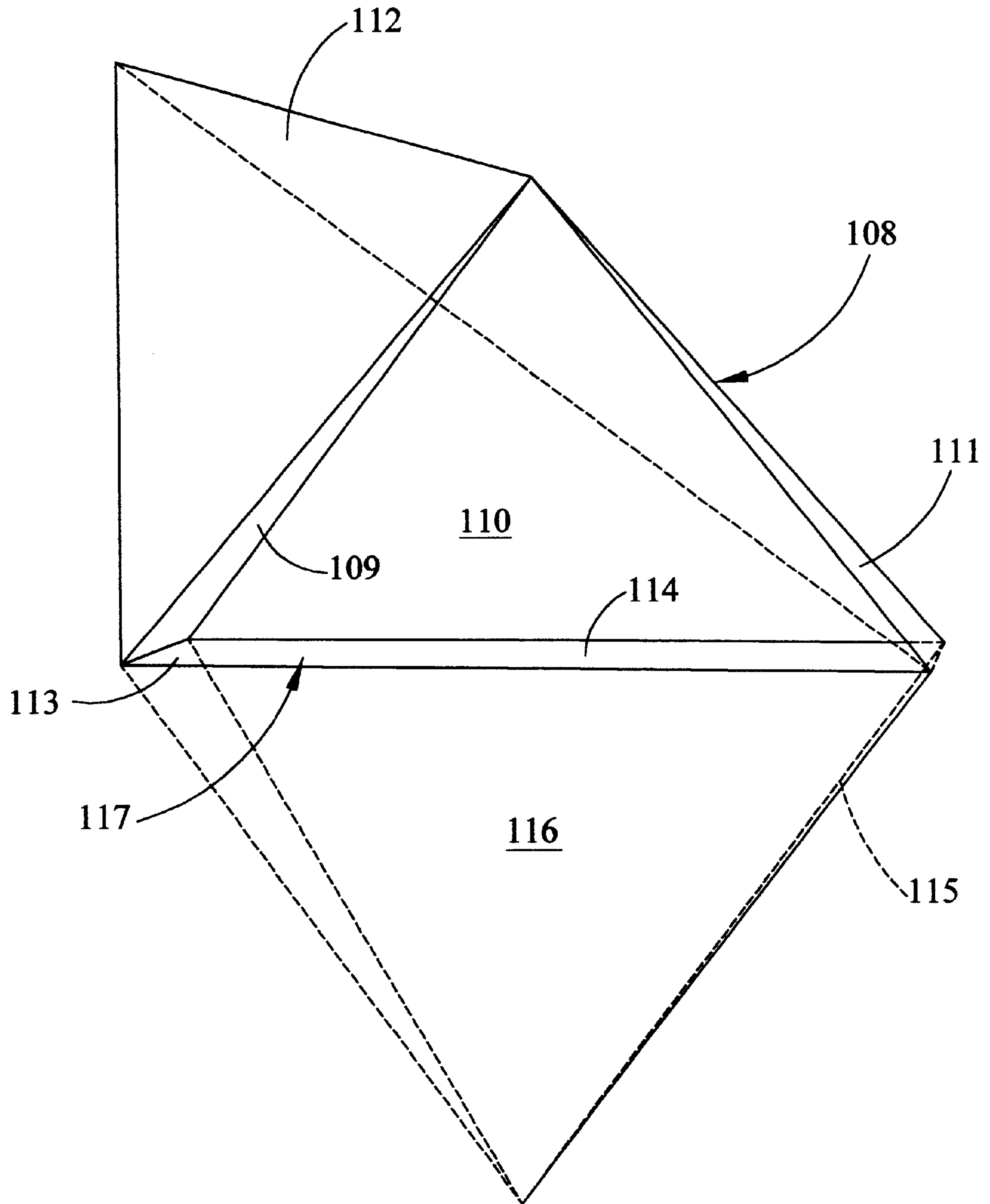


FIG. 9



**MULTI-POLYHEDRAL PUZZLES****CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of copending U.S. Provisional Application Serial No. 60/104,666, filed Oct. 16, 1998.

**BACKGROUND OF THE INVENTION**

## 1. Field of the Invention

This invention relates to geometric puzzles and more particularly, to multi-polyhedral puzzles characterized by four tetrahedra and an octahedron which are divided into respective sets of multiple polyhedron blocks having various configurations, each face of each polyhedron block being one of multiple colors. In a preferred embodiment each octahedron or tetrahedron is divided into a set of polyhedron blocks which is different from the others. In solving the puzzles, each of the octahedron and four tetrahedra is assembled from the corresponding set of polyhedron blocks in an octahedron or tetrahedron-shaped transparent case, according to one of three levels of difficulty. At the most advanced level of difficulty, the octahedron and each of the tetrahedra are assembled from the polyhedron blocks such that abutting faces of adjacent polyhedron blocks match in color and a prescribed color pattern is formed on the respective faces of the octahedron or tetrahedron. At an intermediate level of difficulty, the polyhedron blocks are fitted together to form the prescribed color pattern on the faces of the assembled octahedron or tetrahedron, without regard to matching colors of abutting polyhedron block faces. At the elementary level of difficulty, each of the octahedron and tetrahedra is assembled from the polyhedron blocks irrespective of matching colors of abutting faces on adjacent polyhedron blocks and color pattern formation on the respective faces of the assembled octahedron or tetrahedron. The assembled tetrahedra can be arranged on respective faces of the assembled octahedron to form a large tetrahedron, for storage or packaging purposes.

## 2. Description of the Prior Art

Puzzles have entertained and amused mankind for centuries. In some cases, puzzles have served as educational or instructional tools, in addition to entertainment. A variety of two-dimensional puzzles and games which aid in learning the relationships of similar designs on planar surfaces, are described in such books as "Mathematical Magic Show", by Martin Gardner (1978) and "Puzzles Old and New", by Lewis Hoffman (1893).

Three-dimensional puzzles which require the assembly of smaller three-dimensional structures into a final, larger structure are well known. Comprehensive books have been written which describe a variety of such puzzles, for example, "Puzzles Old and New- How To Make and Solve Them", by J. Slocum and J. Botermans. Most of the three-dimensional puzzles known in the art do not require that designs or indicia on the surfaces of puzzle components be matched in order to complete the puzzle, only that the pieces be assembled to form the final structure. An example of such a puzzle was described in 1970 by House of Games in Canada, which included a cubic puzzle including thirteen rectangular pieces having nine colors disposed on their surfaces. Solving the puzzle requires locating nine different colors on each exposed surface of the final cubic structure. U.S. Pat. No. 3,788,645, discloses a mathematical cube puzzle in which four separate cubes have on each of their edges, one of a set of three color patterns. The object of the

puzzle is to arrange the various cubes relative to one another such that the colors associated with all exposed adjacent playing edges of different cubes match one another. The puzzle has multiple solutions and the pieces can be arranged into a wide variety of different shapes, few of which are symmetrical. The educational value of the puzzle lies in facilitating an understanding of mathematical combinations, but the puzzle teaches little about three-dimensional geometric relationships. A number of U.S. patents, in particular U.S. Pat. Nos. 3,637,216 and 3,655,201, describe novel three-dimensional mechanical device puzzles. The mechanical device puzzles detailed in those patents are characterized by multiple pieces which are permanently attached to one another and do not provide the puzzle solver with three dimensional geometric concepts and spatial relationships while solving the puzzle. Although the puzzles provide the solver with the challenge of matching colors or indicia on exposed surfaces of the puzzle pieces, matching the internal surfaces of the pieces is not an object in solving the puzzle. A puzzle called "Instant Insanity" requires matching colors on the faces of four cubes and has only one solution, which is achieved by trial-and-error. No logic is required to solve the puzzle and the final solution is not a true three-dimensional solution. Thus, the puzzle does not provide education in three-dimensional spacial relationships.

Several U.S. patents describe three-dimensional puzzles which are assembled by fitting together multiple, smaller three-dimensional shapes. Typical of these puzzles is the "Tetrahedron Blocks Capable of Assembly Into Cubes and Pyramids", detailed in U.S. Pat. No. 4,258,479, dated Mar. 31, 1981, to Patricia A. Roane. The puzzle of that invention includes three sets of tetrahedron blocks, each set capable of assembly into a cube, with all the cubes being identical in size. The faces of adjacent tetrahedron blocks magnetically attract each other for assembly into the cube structure. Preferably, the tetrahedron blocks are colored in such a manner that faces of the same size and shape are colored alike, and faces of different sizes and shapes have different colors. U.S. Pat. No. 5,338,034, dated Aug. 16, 1994, to Sabine Asch, discloses a "Three-Dimensional Puzzle" including multiple, irregular pyramids which are assembled into a regular tetrahedron. The apexes of the irregular pyramids all meet at one point in the interior of the in the assembled tetrahedron, and the bases of the irregular pyramids form the regular tetrahedron surfaces. Another "Three-Dimensional Puzzle" to Sabine Asch, is described in U.S. Pat. No. 5,344,148, dated Sep. 6, 1994. The puzzle includes multiple puzzle bodies which are fitted together as chain links to form a chain. The chain can be folded to shape a desired polyhedron such as a tetrahedron, cube or octahedron, for example. U.S. Pat. No. 5,407,201, dated Apr. 18, 1995, to Timothy D. Whitehurst, describes an "Educational Puzzle and Method of Construction". The puzzle includes multiple, three-dimensional pieces which feature indicia overlapping their edges. When a three-dimensional geometric structure is correctly assembled from the pieces, completed indicia appear on all surfaces of the assembled geometric puzzle, with the portion of the indicia on each piece of the surface matching the complimentary portion of the indicia on the adjacent piece.

An object of this invention is to provide multi-polyhedral puzzles for learning about inscribed and circumscribed polyhedra, dual polyhedra and truncation of polyhedra, which puzzle is characterized by four tetrahedra and an octahedron, each assembled from a variety of polyhedron blocks.

Another object of this invention is to provide multi-polyhedral puzzles characterized by four tetrahedra and an



octahedron each assembled from a corresponding set of color-matching polyhedron blocks.

Still another object of this invention is to provide multipolyhedral puzzles including an octahedron and four tetrahedra characterized by various dissections into respective sets of polyhedron blocks, from which each tetrahedron or octahedron is solved or assembled according to one of three levels of difficulty, which typically includes color-matching of abutting block faces.

Yet another object of this invention is to provide multipolyhedral puzzles characterized by four tetrahedra and an octahedron, each of which can be assembled from a corresponding set of polyhedron blocks in such a way as to form a prescribed color pattern on each face of the corresponding octahedron or tetrahedron for exploring various permutations and combinations.

A still further object of this invention is to provide multipolyhedral puzzles including an octahedron and four tetrahedra which are assembled from respective sets of polyhedron blocks, each face of each block being one of multiple colors, wherein same-colored faces of adjacent polyhedron blocks in each octahedron or tetrahedron set can be placed in abutting relationship to assemble the corresponding octahedron or tetrahedron in such a manner that a prescribed color pattern is formed on each face of the octahedron or tetrahedron.

#### SUMMARY OF THE INVENTION

These and other objects of the invention are provided in multipolyhedral puzzles including an octahedron and four tetrahedra, each of which is assembled from a corresponding set of polyhedron blocks, each face of each of the polyhedron blocks being one of several different colors. In a preferred embodiment each set of polyhedron blocks represents a dissection or division of the corresponding octahedron or tetrahedron which is different from that of the other sets. The octahedron and each tetrahedron are assembled from the corresponding set of polyhedron blocks inside a corresponding octahedron or tetrahedron-shaped transparent case and according to one of three levels of difficulty, the elementary level of difficulty involving assembly of the octahedron or tetrahedron irrespective of matching colors of abutting faces on adjacent polyhedron blocks. The intermediate level of difficulty involves assembly of the octahedron or tetrahedron to form a prescribed color pattern on the respective faces of the octahedron or tetrahedron, without regard to matching colors of abutting faces on adjacent polyhedron blocks. According to the advanced level of difficulty, same-colored faces of adjacent polyhedron blocks are placed in abutting relationship as the octahedron or tetrahedron is assembled inside the corresponding transparent case and a prescribed color pattern is formed on the respective faces of the octahedron or tetrahedron. The assembled tetrahedra can be arranged on respective faces of the assembled octahedron to form respective vertices of a large tetrahedron or tripyramid in which the octahedron is inscribed, for storage or packaging purposes, for example.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the accompanying drawings, wherein:

FIG. 1 is a front view of preferred embodiments of the assembled octahedron and each assembled tetrahedron of the multipolyhedral puzzles of this invention, with the tetrahedra arranged on respective faces of the octahedron to form a large tetrahedron;

FIG. 2 is an exploded view of the multipolyhedral puzzles illustrated in FIG. 1, with each tetrahedron component separated from the central octahedron component;

FIG. 3 is a front view of a transparent case in which the multiple polyhedron blocks of each tetrahedron are fitted in assembling each tetrahedron in preferred embodiments of the multipolyhedral puzzles;

FIG. 4 is an exploded view of a dual tetrahedron of the multipolyhedral puzzles;

FIG. 4A is a bottom view of an unfolded, first irregular, large tetrahedron polyhedron block of the dual tetra illustrated in FIG. 4;

FIG. 4B is a bottom view of an unfolded, top tripyramid polyhedron block of the dual tetra;

FIG. 4C is a bottom view of an unfolded, regular tetrahedron polyhedron block of the dual tetra;

FIG. 5 is an exploded view of an icosahedron component of the multipolyhedral puzzles;

FIG. 5A is a central, icosahedral polyhedron block of the icosahedron illustrated in FIG. 5;

FIG. 5B is a bottom view of an unfolded, first small tetrahedron polyhedron block of the icosahedron;

FIG. 5C is a bottom view of an unfolded, first icosahedron polyhedron block of the icosahedron;

FIG. 5D is a bottom view of an unfolded, first large tetrahedron polyhedron block of the icosahedron;

FIG. 5E is a bottom view of an unfolded, icosahedron polyhedron block of the icosahedron;

FIG. 6 is an exploded view of a cuboctahedron component of the multipolyhedral puzzles;

FIG. 6A is a perspective view of the central, cuboctahedral polyhedron block of the cuboctahedron illustrated in FIG. 6;

FIG. 6B is a bottom view of an unfolded, cuboctahedron polyhedron block of the cuboctahedron illustrated in FIG. 6;

FIG. 6C is a bottom view of an unfolded, first square pyramid polyhedron block of the cuboctahedron;

FIG. 6D is a bottom view of an unfolded, first pentahedron polyhedron block of the cuboctahedron;

FIG. 7 is an exploded view of a truncated tetrahedron component of the multipolyhedral puzzles;

FIG. 7A is a bottom view of an unfolded, first T-tetrahedron polyhedron block of the T-tetra illustrated in FIG. 7;

FIG. 7B is a bottom view of an unfolded, first T-tripyramid polyhedron block of the T-tetra;

FIG. 7C is a bottom view of an unfolded, first T-pentahedron polyhedron blocks of the T-tetra;

FIG. 8 is an exploded view of the octahedron of the multipolyhedral puzzles;

FIG. 8A is a bottom view of the unfolded, top tetrapyramid polyhedron block of the octahedron illustrated in FIG. 8;

FIG. 8B is a bottom view of the unfolded, first irregular tetrahedron polyhedron block of the octahedron illustrated in FIG. 8;

FIG. 8C is a bottom view of the unfolded, central cube polyhedron block of the octahedron illustrated in FIG. 8; and

FIG. 9 is a perspective view of a transparent case in which the multiple polyhedron blocks of the octahedron are fitted, in assembling the octahedron in a preferred embodiment of the multipolyhedral puzzles.



## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring initially to FIGS. 1 and 2 of the drawings, in a preferred embodiment the multi-polyhedral puzzles, hereinafter referred to as the puzzles, of this invention are collectively illustrated by reference numeral 1. As illustrated in FIGS. 1 and 2, the puzzles 1 include an octahedron 3, a regular dual tetrahedron 30, hereinafter referred to as dual tetra, a regular icosahedron 43, hereinafter icosahedron, a regular cuboctahedron 63, hereinafter cuboctahedron, and a regular truncated tetrahedron 80, hereinafter T-tetra, each assembled from a corresponding set of multiple polyhedron blocks according to one of three levels of difficulty, as hereinafter described. As illustrated in FIG. 2, the assembled octahedron 3 includes a left face 4, a right face 5, an icosahedron face 6 and a dual face 7 in the square pyramid facing the viewer, along with a T-face 8, a cuboctahedron face 9, a bottom face 10 and a rear face 11, in the square pyramid facing away from the viewer, as indicated by the phantom lead lines. A selected triangular face of each assembled dual tetra 30, icosahedron 43, cuboctahedron 63 and T-tetra 80 is typically fitted against the congruent triangular dual face 7, icosahedron face 6, cuboctahedron face 9 and T-face 8, respectively, of the octahedron 3, as illustrated in FIG. 2, to form respective vertices of a large tetrahedron 2, as illustrated in FIG. 1, in order to facilitate collective packaging or efficient storage of the puzzles 1, for example. When the dual tetra 30, icosahedron 43, cuboctahedron 63 and truncated tetra 80 are so arranged on the octahedron 3 to form the large tetrahedron 2, the left face 4, right face 5, bottom face 10 (in phantom) and rear face 11 (also in phantom) of the octahedron 3 remain exposed on the respective faces of the large tetrahedron 2, such that the octahedron 3 is inscribed in the large tetrahedron 2, as illustrated in FIG. 1.

Referring next to FIGS. 8 and 8C of the drawings, the octahedron 3 is assembled from multiple polyhedron blocks, each typically constructed from paper, cardboard, wood or molded plastic and having various configurations, and each face of each polyhedron block is typically one of three colors. In a preferred embodiment the octahedron 3 is assembled inside a transparent, typically plastic octahedron case 108, as illustrated in FIG. 9. The octahedron case 108 includes a first wall 109, second wall 110, third wall 111, fourth wall 113, fifth wall 114, sixth wall 115 and seventh wall 116, defining a case interior 117. A case door 112 is hinged to the first wall 109 for reversibly closing the case interior 117. The first wall 109, second wall 110, third wall 111, fourth wall 113, fifth wall 114, sixth wall 115, seventh wall 116 and closed case door 112 define 1st-8th faces, respectively, of the octahedron 3. The octahedron 3 includes a first irregular tetrahedron 19, illustrated in the unfolded configuration in FIG. 8B, and including a first face 19a, a second face 19b, a third face 19c and a fourth face 19d. The first irregular tetrahedron 19 is constructed from the unfolded configuration by folding along the fold lines 121c and 121d and matching outside edges 121a of the third and fourth faces 19c and 19d with the respective outside edges 121a of the second face 19b to form the first irregular tetrahedron 19 illustrated in FIG. 8. The proportion of the length of each edge of the octahedron case 108 (FIG. 9) to the length of each of the outside edges 121a, inside edges 121b, fold lines 121c and fold line 121d of the first irregular tetrahedron 19 is 1:0.5774, 1:0.4715, 1:0.5774 and 1:1, respectively. The octahedron 3 includes second, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth and eleventh irregular tetrahedra, designated by reference numerals 20-29, respectively, and a twelfth irregular tetrahedron 42,

each of which has the same configuration and dimensions as the first irregular tetrahedron 19 described above with respect to FIG. 8B.

The octahedron 3 further includes a top tetrapyramid 13 illustrate configuration in FIG. 8A, and including a first face 13a, a second face 13b, a third face 13c, a fourth face 13d and a fifth face 13e. The top tetrapyramid 13 is constructed from the unfolded configuration illustrated in FIG. 8A, by folding along the fold lines 120a and joining adjacent faces along the respective face edges 120b to form the top tetrapyramid 13 illustrated in FIG. 8. The proportion of the length of each edge of the octahedron case 108 to the length of each fold line 120a is 1:0.4715, whereas the proportion of the length of each edge of the tetrahedron case 101 to the length of each of the face edges 120b is 1:0.5774. The octahedron 3 includes a bottom tetrapyramid 14, a left rear tetrapyramid 15, a right rear tetrapyramid 16, a left front tetrapyramid 17, and a right front tetrapyramid 18, each of which has the same configuration and dimensions as the top tetrapyramid 13 described above with respect to FIG. 8A.

The octahedron 3 also includes a central cube 12 illustrated in unfolded configuration in FIG. 8C and having a first face 12a, a second face 12b, a third face 12c, a fourth face 12d, a fifth face 12e and a sixth face 12f. The central cube 12 is constructed from the unfolded configuration by folding along the fold lines 122a and joining the faces along the respective cube edges 122. The proportion of the length of each edge of the octahedron case 108 to the length of each of the cube edges 122 and fold lines 122a is 1:0.4715.

Referring again to FIGS. 1 and 2 and to FIGS. 8 and 9 of the drawings, at an advanced level of difficulty in assembling the octahedron 3 inside the octahedron case 108 and according to one of several possible methods, the first irregular tetrahedron 19 is first fitted in the case interior 117 of the open octahedron case 108, with the red first face 19a of the first irregular tetrahedron 19 abutting against the seventh wall 116 and the green second face 19b against the fourth wall 113 of the octahedron case 108. The second irregular tetrahedron 20 is next fitted in the case interior 117 in bordering relationship to the first irregular tetrahedron 19, with the green first face 20a of the second irregular tetrahedron 20 abutting against the seventh wall 116 and the light green second face 20b against the sixth wall 115 of the octahedron case 108. The third irregular tetrahedron 21 is placed in the case interior 117 in bordering relationship to the second irregular tetrahedron 20, with the red first face 21a of the third irregular tetrahedron 21 abutting against the fifth wall 114 and the green second face 21b against the sixth wall 115 of the octahedron case 108. The fourth irregular tetrahedron 22 is next fitted between and in bordering relationship to the first irregular tetrahedron 19 and third irregular tetrahedron 21, with the green first face 22a of the fourth irregular tetrahedron 22 resting against the fifth wall 114 and the light green second face 22b against the fourth wall 113 of the octahedron case 108. The inverted, bottom tetrapyramid 14 is cradled between the first irregular tetrahedron 19, second irregular tetrahedron 20, third irregular tetrahedron 21 and fourth irregular tetrahedron 22. The light green first face 14a of the bottom tetrapyramid 14 rests against the light green third face 19c of the first irregular tetrahedron 19. Furthermore, the red second face 14b rests against the red third face 20c of the second irregular tetrahedron 20, the light green third face 14c, against the light green third face 21c of the third irregular tetrahedron 21 and the red fourth face 14d against the red third face 22c of the fourth irregular tetrahedron 22. The fifth irregular tetrahedron 23 is then fitted in the case interior 117 of the



octahedron case **108** in bordering relationship to said third irregular tetrahedron and said fourth irregular tetrahedron, with the red first face **23a** abutting against the second wall **110** and the light green second face **23b**, against the fifth wall **114**, of the octahedron case **108**. The left rear tetrapyramid **15** is next placed in the case interior **117**, with the red first face **15a** resting on the red fourth face **22d** of the fourth irregular tetrahedron **22** and the green second face **15b** abutting against the green third face **23c** of the fifth irregular tetrahedron **23**. The right rear tetrapyramid **16** is then placed in the case interior **117**, with the light green first face **16a** resting on the light green fourth face **21d** of the third irregular tetrahedron **21** and the green second face **16b** abutting against the green fourth face **23d** of the fifth irregular tetrahedron **23**. The sixth irregular tetrahedron **24** is next placed in the case interior **117**, in bordering relationship with said first irregular tetrahedron **19** and said fourth irregular tetrahedron **22**, with the light green first face **24a** abutting against the first wall **109** and the red second face **24b** against the fourth wall **113**, of the octahedron case **108**. The green third face **24c** abuts against the green third face **15c** of the left rear tetrapyramid **15**. The seventh irregular tetrahedron **25** is then fitted in the case interior **117** in bordering relationship to said second irregular tetrahedron **20** and said third irregular tetrahedron **21**, with the light green first face **25a** abutting against the third wall **111** and the red second face **25b** against the sixth wall **115**, of the octahedron case **108**. The green third face **25c** abuts against the green third face **16c** of the right rear tetrapyramid **16**. The central cube **12** is next placed in the case interior **117**, with the green first face **12a** resting on the green fifth face **14e** of the bottom tetrapyramid **14**. The light green second face **12b** abuts against the light green fourth face **15d** of the left rear tetrapyramid **15** and the red third face **12c** against the red fourth face **16d** of the right rear tetrapyramid **16**. The left front tetrapyramid **17** is then placed in the case interior **117**, with the light green first face **17a** resting on the light green fourth face **19d** of the first irregular tetrahedron **19**, the green second face **17b** abutting against the green fourth face **24d** of the sixth irregular tetrahedron **24** and the red third face **17c** against the red fourth face **12d** of the octahedron cube **12**. The right front tetrapyramid **18** is next fitted in the case interior **117**, with the red first face **18a** resting on the red fourth face **20d** of the second irregular tetrahedron **20**, the green second face **18b** abutting against the green fourth face **25d** of the seventh irregular tetrahedron **25** and the light green third face **18c** against the light green fifth face **12e** of the octahedron cube **12**. The eighth irregular tetrahedron **26** is fitted between the left front tetrapyramid **17** and right front tetrapyramid **18** and in bordering relationship to the first irregular tetrahedron **19** and the second irregular tetrahedron **20**, with the red first face **26a** facing the case door **112** and the light green second face **26b** resting against the seventh wall **116** of the octahedron case **108**. The green third face **26c** abuts against the green fourth face **17d** of the left front tetrapyramid **17** and the green fourth face **26d** against the green fourth face **18d** of the right front tetrapyramid **18**. The ninth irregular tetrahedron **27** is next placed in the case interior **117** in bordering relationship to said fifth irregular tetrahedron **23** and said sixth irregular tetrahedron **24**, with the red first face **27a** resting on the red fifth face **15e** of the left rear tetrapyramid **15** and the green second face **27b** abutting against the first wall **109** and the light green third face **27c** against the second wall **110** of the octahedron case **108**. The tenth irregular tetrahedron **28** is next placed in the case interior **117** in bordering relationship to the fifth irregular tetrahedron **23**, the seventh irregular tetrahedron **25** and

the ninth irregular tetrahedron **27**, with the light green first face **28a** resting on the light green fifth face **16e** of the right rear tetrapyramid **16**. The red second face **28b** abuts against the third wall **111** and the green third face **28c** against the second wall **110** of the octahedron case **108**. The top tetrapyramid **13** is then fitted inside the case interior **117**, with the green first face **13a** resting on the green sixth face **12f** of the central octahedron cube **12**. The light green second face **13b** abuts against the light green fourth face **28d** of the tenth irregular tetrahedron **28** and the red third face **13c**, against the red fourth face **27d** of the ninth irregular tetrahedron **27**. The eleventh irregular tetrahedron **29** is next fitted in the case interior **117** in bordering relationship to the seventh irregular tetrahedron **25**, the eighth irregular tetrahedron **26** and the tenth irregular tetrahedron **28** with the red first face **29a** resting against the red fourth face **13d** of the top tetrapyramid **13** and the red second face **29b** against the red fifth face **18e** of the right front tetrapyramid **18**. The green third face **29c** abuts against the third wall **111** and the light green fourth face **29d** faces the case door **112** of the octahedron case **108**. To complete assembly of the octahedron **3** in the tetrahedron case **101**, the twelfth irregular tetrahedron **42** is fitted in the remaining space in case interior of **117** in bordering relationship to the sixth irregular tetrahedron **24**, the eighth irregular tetrahedron **26**, the ninth irregular tetrahedron **27** and the eleventh irregular tetrahedron **29**, with the light green first face **42a** resting against the light green fifth face **13e** of the top tetrapyramid **13** and the light green second face **42b** resting on the light green fifth face **17e** of the left front tetrapyramid **17**. The red third face **42c** abuts against the first wall **109** and the green fourth face **42d** faces the case door **112** of the octahedron case **108**. Finally, the case door **112** of the polyhedron case **108** is closed against the red first face **26a** of the eighth irregular tetrahedron **26**, the light green fourth face **29d** of the eleventh irregular tetrahedron **29** and the green fourth face **42d** of the twelfth irregular tetrahedron **42**. When the polyhedron blocks are so arranged in the assembled octahedron **3** in the octahedron case **108**, each triangular face of the octahedron **3** is bounded by a green face of one irregular tetrahedron, a red face of another irregular tetrahedron and a light green face of still another irregular tetrahedron. For example, referring again to FIG. 2 of the drawings, when the top or dual face **7** of the large octahedron **3** corresponds to the case door **112** of the octahedron case **108**, the left face **4** of the octahedron **3**, corresponding to the seventh wall **116** of the octahedron case **108**, is bounded by the light green second face **26b** of the eighth irregular tetrahedron **26**, the green first face **20a** of the second irregular tetrahedron **20** and the red first face **19a** of the first irregular tetrahedron **19**. Likewise, the right face **5** of the octahedron **3**, corresponding to the third wall **111** of the octahedron case **108**, is bounded by the light green first face **25a** of the seventh irregular tetrahedron **25**, the red second face **28b** of the tenth irregular tetrahedron **28** and the green third face **29c** of the eleventh irregular tetrahedron **29**. It will be appreciated by those skilled in the art that the foregoing description involves an advanced level of difficulty in assembling the octahedron **3** in the octahedron case **108**, by matching colors of abutting, congruent faces of adjacent polyhedron blocks in the puzzle. At an intermediate level of difficulty in assembling the octahedron **3**, the polyhedron blocks are assembled in the octahedron case **108** to form the three-color pattern on each face of the octahedron **3**, but without regard to matching colors of abutting congruent faces of adjacent polyhedron blocks. At an elementary level of difficulty in assembling the octahedron **3**, the polyhedron blocks are assembled in the



octahedron case **108** without regard to matching colors of abutting, congruent faces of adjacent polyhedron blocks or formation of the three-color pattern on each face of the octahedron **3**. It is understood that each color on the respective faces of each polyhedron block can be substituted by one of three different colors other than green, light green and red, as described above, with the same color on different faces substituted by the same color. In that case, matching colors of abutting faces on adjacent polyhedron blocks according to the advanced level of difficulty described above would provide the same degree of difficulty in assembling the octahedron **3**, as well as the prescribed color pattern formation on each face of the octahedron **3**.

Referring now to FIGS. **3** and particularly to FIGS. **4–4C** of the drawings, in a preferred embodiment the dual tetra **30** is assembled inside a transparent, typically plastic, pyramidal tetrahedron case **101**, illustrated in phantom. The tetrahedron case **101** has four vertices **101a** and includes a left wall **102**, a right wall **103** and a bottom wall **104** defining a case interior **105**, with a case door **106** hinged to the bottom wall **104** for reversibly closing the case interior **105**, as illustrated in FIG. **3**. The dual tetra **30** includes a first irregular, large tetrahedron **36** illustrated in unfolded configuration in FIG. **4A** and including a first face **36a**, second face **36b**, third face **36c** and fourth face **36d**. The first irregular, large tetrahedron **36** is constructed from the unfolded configuration illustrated in FIG. **4A**, by folding along the fold lines **124c** and **124d** and matching outside edges **124a** of the third and fourth faces **36c** and **36d**, respectively, with the respective outside edges **124a** of the first face **36a**. The proportion of the length of each edge of the tetrahedron case **101** (FIG. **3**) to the length of each of the outside edges **124a**, inside edges **124b**, fold lines **124c** and fold line **124d**, is 1:0.5774, 1:0.3333, 1:0.5774 and 1:1, respectively. The dual tetra **30** includes second, third, fourth, fifth and sixth irregular, large tetrahedron, designated by reference numerals **37–41**, respectively, in FIG. **4**, each of which has the same configuration and dimensions as the first irregular, large tetrahedron **36** described above with respect to FIG. **4A**. The dual tetra **30** further includes a top tripyramid **32**, illustrated in the unfolded configuration in FIG. **4B** and including a first face **32a**, a second face **32b**, a third face **32c** and a fourth face **32d**. The top tripyramid **32** is constructed from the unfolded configuration illustrated in FIG. **4B**, by folding along the fold lines **125c** and base fold line **125d**, and joining the respective base edges **125a** and the face edges **125b**. The proportion of the length of each edge of the tetrahedron case **101** to the length of each base edge **125a**, face edge **125b**, fold lines **125c** and base fold line **125d**, is 1:0.3333, 1:0.5774, 1:0.5774 and 1:0.3333, respectively. The dual tetra **30** includes a left tripyramid **33**, a right tripyramid **34** and a rear tripyramid **35**, each of which has the same configuration and dimensions as the top tripyramid **32** described above with respect to FIG. **4B**. The dual tetra **30** further includes a regular tetrahedron, illustrated in the unfolded configuration in FIG. **4C** and having a first face **31a**, a second face **31b**, a third face **31c** and a fourth face **31d**. The regular tetrahedron **31** is constructed from the unfolded configuration illustrated in FIG. **4C**, by folding along the fold lines **126b** and joining the adjacent face edges **126a**. The proportion of the length of each edge of the tetrahedron case **101** to the length of each face edge **126a** and each fold line **126b** is 1:0.3333.

Referring again to FIGS. **1** and **2** and particularly to FIGS. **3** and **4** of the drawings, at an advanced level of difficulty an advanced level of difficulty in assembling the dual tetra **30** in the tetrahedron case **101** according to one of several

possible methods, the first irregular, large tetrahedron **36** is initially placed in the case interior **105** of the open tetrahedron case **101**, with the red first face **36a** abutting against the left wall **102** and the green second face **36b** resting on the bottom wall **104** of the tetrahedron case **101**. The second irregular, large tetrahedron **37** is next fitted in the case interior **105**, with the purple first face **37a** abutting against the right wall **103** and the green second face **37b** resting on the bottom wall **104** of the tetrahedron case **101**. The rear tripyramid **35** is next inserted between the first irregular, large tetrahedron **36** and the second irregular, large tetrahedron **37**, with the purple first face **35a** resting against the purple third face **36c** of the first irregular, large tetrahedron **36** and the red second face **35b**, against the red third face **37c** of the second irregular, large tetrahedron **37**. The third irregular, large tetrahedron **38** is next fitted in the case interior **105**, with the green first face **38a** resting on the green third face **35c** of the rear tripyramid **35**. The red second face **38b** abuts against the left wall **102** and the purple third face **38c** against the right wall **103** of the tetrahedron case **101**. The fourth irregular, large tetrahedron **39** is next placed between the first irregular, large tetrahedron **36** and second irregular, large tetrahedron **37**, such that the green first face **39a** of the fourth irregular, large tetrahedron **39** rests on the bottom wall **104** and the blue second face **39b** faces the case door **106** of the tetrahedron case **101**. The left tripyramid **33** is then fitted between the first irregular, large tetrahedron **36** and fourth irregular, large tetrahedron **39**, such that the blue first face **33a** abuts against the blue fourth face **36d** of the first irregular, large tetrahedron **36**, and the red second face **33b** against the red third face **39c** of the fourth irregular, large tetrahedron **39**. The right tripyramid **34** is next fitted between the second irregular, large tetrahedron **37** and fourth irregular, large tetrahedron **39**, such that the blue first face **34a** rests against the blue fourth face **37d** of the second irregular, large tetrahedron **37** and the purple second face **34b** against the purple fourth face **39d** of the fourth irregular, large tetrahedron **39**. The regular tetrahedron **31** is then placed in the case interior **105**, such that the blue rear or first face **31a** abuts against the blue fourth face **35d** of the rear tripyramid **35**, the purple second face **31b** against the purple third face **33c** of the left tripyramid **33** and the red third face **31c** against the red third face **34c** of the right tripyramid **34**. The top tripyramid **32** is next placed in the case interior **105**, with the green bottom or first face **32a** resting on the green fourth face **31d** of the regular tetrahedron **31** and the blue second or rear face **32b** against the blue fourth face **38d** of the third irregular, large tetrahedron **38**. The fifth irregular, large tetrahedron **40** is next placed in the case interior **105**, with the purple first face **40a** abutting against the purple third face **32c** of the top tripyramid **32** and the green second face **40b** resting on the green fourth face **33d** of the left tripyramid **33**. The blue third face **40c** faces the case door **106** and the red fourth face **40d** abuts against the left wall **102** of the tetrahedron case **101**. Finally, to complete assembly of the dual small tetrahedron **30**, the sixth irregular, large tetrahedron **41** is fitted in the remaining space in the case interior **105**, with the red first face **41a** abutting against the red fourth face **32d** of the top tripyramid **32** and the green second face **41b** resting on the green fourth face **34d** of the right tripyramid **34**. The blue third face **41c** faces the case door **106** and the purple fourth face **41d** abuts against the right wall **103** of the tetrahedron case **101**. Finally, the case door **106** of the tetrahedron case **101** is closed against the blue second face **39b** of the fourth irregular, large tetrahedron **39**, the blue third face **40c** of the fifth irregular, large tetrahedron **40** and the blue third face **41c** of the sixth irregular, large tetrahedron **41**.



As illustrated in FIGS. 1 and 2 of the drawings, when the polyhedron blocks are assembled into the dual tetra 30 in the tetrahedron case 101 according to the foregoing description, each face of the dual tetra 30 is the same color. For example, as described above, the blue third face 40c of the fifth irregular, large tetrahedron 40, the blue third face 41c of the sixth irregular, large tetrahedron 41 and the blue second face 39b of the fourth irregular, large tetrahedron 39 combine to form a front face 30a of the dual tetra 30 corresponding to the closed case door 106 of the tetrahedron case 101, which is blue in color. In similar fashion, the purple fourth face 41d of the sixth irregular, large tetrahedron 41, the purple fourth face 38c of the third irregular, large tetrahedron 38 and the purple first face 37a of the second irregular, large tetrahedron 37, combine to form a right face 30b of the dual tetra 30, which is purple in color and corresponds to the right wall 103 of the tetrahedron case 101. As with the description of assembling the octahedron 3 set forth above, the foregoing description involves an advanced or difficult level of assembling the dual tetra 30 from the constituent polyhedron blocks. At an intermediate level of difficulty in assembling the dual tetra 30, the polyhedron blocks are assembled in the tetrahedron case 101 to form the uniform color pattern on each face of the dual tetra 30, but without regard to matching colors of abutting faces of adjacent polyhedron blocks. At an elementary level of assembling the dual tetra 30, the polyhedron blocks are fitted in the tetrahedron case 101 in the same orientations described above, although without regard to matching colors of abutting faces on adjacent polyhedron blocks or uniform color formation on each face of the dual tetra 30. It is understood that each color on the respective faces of each polyhedron block can be substituted by one of four different colors other than red, blue, purple and green, as described above, with the same color on different faces substituted by the same color. Accordingly, matching colors of abutting faces on adjacent polyhedron blocks according to the advanced level of difficulty described above would provide the same degree of difficulty in assembling the dual tetra 30, as well as a uniform color pattern formation on each face of the dual tetra 30.

Referring next to FIGS. 5–5E of the drawings, the icosahedron tetra 43 is assembled from multiple polyhedron blocks in a second tetrahedron case 101 (FIG. 2) according to an advanced, intermediate or elementary level of difficulty, as hereinafter described. The icosahedron tetra 43 includes a first small tetrahedron 49, illustrated in the unfolded configuration in FIG. 5B and including a first face 49a, a second face 49b, a third face 49c and a fourth face 49d. The first small tetrahedron 49 is constructed from the unfolded configuration illustrated in FIG. 5B, by folding along the front fold line 128d and longitudinal fold line 128f and joining the front edges 128a, and folding along the rear fold line 128e and joining the rear edges 128c and inside edges 128b. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the front edges 128a, the inside edges 128b, the rear edges 128c, the front fold line 128d, the rear fold line 128e and the longitudinal fold line 128f, is 1:0.25, 1:0.25, 1:0.45, 1:0.25, 1:0.45 and 1:1, respectively. The icosahedron tetra 43 includes a first small tetrahedron 49, a second small tetrahedron 50, a third small tetrahedron 51, a fourth small tetrahedron 52, a fifth small tetrahedron 53 and a sixth small tetrahedron 54, each of which has the same configuration and dimensions as the first small tetrahedron 49 described above with respect to FIG. 5B. The icosahedron tetra 43 includes a first icosahedron pyramid 45, illustrated in the unfolded configuration in FIG. 5C and having a first face 45a, a second face 45b, a third face 45c and a fourth face

45d. The first icosahedron pyramid 45 is constructed from the unfolded configuration by folding along the fold lines 129c and base fold line 129d, and joining the base edges 129a and face edges 129b. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the base edges 129a, the face edges 129b, the fold lines 129c and base fold line 129d, is 1:0.25, 1:0.45, 1:0.45 and 1:0.25, respectively. The icosahedron tetra 43 includes a second icosahedron pyramid 46, a third icosahedron pyramid 47 and a fourth icosahedron pyramid 48, each of which has the same configuration and dimensions as the first icosahedron pyramid 45 described above with respect to FIG. 5c.

The icosahedron tetra 43 further includes a first large tetrahedron 55, illustrated in the unfolded configuration in FIG. 5D and having a first face 55a, a second face 55b, a third face 55c and a fourth face 55d. The first large tetrahedron 55 is constructed from the unfolded configuration by folding along the front fold line 130d and longitudinal fold line 130f and joining the front edges 130a and folding along the rear fold line 130e and joining the rear edges 130c and inside edges 130b. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the front edges 130a, inside edges 130b, rear edges 130c, front fold line 130d, rear fold line 130e and longitudinal fold line 130f, is 1:0.45, 1:0.25, 1:0.7, 1:0.45, 1:0.61 and 1:1, respectively. The icosahedron tetra 43 includes a second large tetrahedron 56, a third large tetrahedron 57, a fourth large tetrahedron 58, a fifth large tetrahedron 59 and a sixth large tetrahedron 60, each of which has the same configuration and dimensions as the first large tetrahedron 55 described above with respect to FIG. 5D. The icosahedron tetra 43 includes an icosahedron 44, illustrated in the unfolded configuration in FIG. 5E and having twenty faces, designated by reference numerals 44a–44t, respectively. The icosahedron 44 is constructed from the unfolded configuration by folding along the fold lines 132b and joining the respective face edges 132a, according to the knowledge of those skilled in the art. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the face edges 132a and fold lines 132b, is 1:0.25.

Referring again to FIGS. 1–3 and particularly to FIG. 5 of the drawings, in assembling the icosahedron tetra 43 from multiple polyhedron blocks in a second tetrahedron case 101, at an advanced level of difficulty and according to one of several possible methods, the first large tetrahedron 55 is initially placed in the case interior 105 of the open tetrahedron case 101, with the blue first face 55a abutting against the left wall 102 and the light green second face 55b resting on the bottom wall 104 of the tetrahedron case 101. The second large tetrahedron 56 is then placed in the case interior 105, with the orange first face 56a abutting against the right wall 103 and the light green second face 56b resting on the bottom wall 104 of the tetrahedron case 101. The first icosahedron pyramid 45 is next placed in the case interior 105, with the blue first face 45a resting against the blue third face 56c of the second large tetrahedron 56. The first small tetrahedron 49 is next placed in the case interior 105, with the orange first face 49a resting against the orange second face 45b of the first icosahedron pyramid 45, the yellow second face 49b resting on the yellow third face 55c of the first large tetrahedron 55 and the light green third face 49c abutting against the left wall 102 of the tetrahedron case 101. The third large tetrahedron 57 is then fitted in the case interior 105, with the yellow first face 57a resting on the yellow third face 45c of the first icosahedron pyramid 45. The blue second face 57b of the third large tetrahedron 57 abuts against the left wall 102 and the orange third face 57c against the right wall



103 of the tetrahedron case 101. The second small tetrahedron 50 is next fitted in the case interior 105, with the blue first face 50a resting on the blue fourth face 56d of the second large tetrahedron 56 and the yellow second face 50b of the second small tetrahedron 50 abutting against the right wall 103 of the tetrahedron case 101. The icosahedron 44, illustrated in FIG. 5a, is then fitted in the case interior 105, with the orange first face 44a abutting against the orange fourth face 49d of the first small tetrahedron 49, the light green second face 44b against the light green fourth face 45d of the first icosahedron 45, the blue third face 44c against the blue fourth face 56d of the second large tetrahedron 56, the orange fourth face 44d against the orange third face 50c of the second small tetrahedron 50 and the yellow sixteenth face 44p resting against the yellow third face 55c of the first large tetrahedron 55. When the icosahedron 44 is so fitted in the tetrahedron case 101, the icosahedron 44 is inscribed in the icosahedron 43 with the red seventh face 44g facing the case door 106, the red tenth face 44j abutting against the left wall 102, the red thirteenth face 44m, against the right wall 103 and the red seventeenth face 44q resting on the bottom wall 104, of the tetrahedron case 101. The second icosahedron 46 is next fitted in the case interior 105, with the blue first face 46a abutting against the blue twentieth face 44t of the icosahedron 44 and the yellow second face 46b against the yellow fourth face 55d of the first large tetrahedron 55. The fourth large tetrahedron 58 is next placed in the case interior 105, with the light green first face 58a abutting against the light green eighteenth face 44r of the icosahedron 44. The light green second face 58b rests on the bottom wall 104 and the yellow third face 58c faces the case door 106 of the tetrahedron case 101. The third icosahedron 47 is then fitted in the case interior 105, with the yellow first face 47a abutting against the yellow fifth face 44e of the icosahedron 44, the orange second face 47b against the orange fourth face 50d of the second small tetrahedron 50 and the light green third face 47c against the light green fourth face 58d of the fourth large tetrahedron 58. The third small tetrahedron 51 is next inserted between the second icosahedron 46 and fourth large tetrahedron 58, with the orange first face 51a abutting against the orange third face 46c of the second icosahedron 46, the orange second face 51b abutting against the orange nineteenth face 44s of the icosahedron 44 and the light green third face 51c resting on the light green first face 58a of the fourth large tetrahedron 58. The blue fourth face 51d faces the case door 106 of the tetrahedron case 101. The fifth large tetrahedron 59 is next placed in the case interior 105, with the light green first face 59a resting on the light green fourteenth face 44n of the icosahedron 44. The orange second face 59b abuts against the right wall 103 and the yellow third face 59c faces the case door 106 of the tetrahedron case 101. The fourth small tetrahedron 52 is next placed in the case interior 105, with the blue first face 52a resting on the blue sixth face 44f of the icosahedron 44, the blue second face 52b resting on the blue fourth face 47d of the third icosahedron 47, the light green third face 52c abutting against the light green first face 59a of the fifth large tetrahedron 59 and the blue fourth face 52d facing the closed case door 106 of the tetrahedron case 101. The fifth small tetrahedron 53 is next placed in the case interior 105, with the blue first face 53a resting on the blue eleventh face 44k of the icosahedron 44 and the yellow second face 53b abutting against the yellow fourth face 57d of the third large tetrahedron 57. The light green third face 53c abuts against the left wall 102 of the tetrahedron case 101. The fourth icosahedron 48 is then placed in the case interior 105, with the orange first face 48a resting on the

orange fifteenth face 44o of the icosahedron 44, the light green second face 48b abutting against the light green fourth face 59d of the fifth large tetrahedron 59 and the blue third face 48c abutting against the blue fourth face 53d of the fifth small tetrahedron 53. The sixth large tetrahedron 60 is next fitted in the case interior 105, with the light green first face 60a resting against the light green fourth face 46d of the second icosahedron 46 and the light green second face 60b resting against the light green ninth face 44i of the icosahedron 44. The blue third face 60c abuts against the left wall 102 and the yellow fourth face 60d, against the closed case door 106, of the tetrahedron case 101. To complete assembly of the icosahedron 43, the sixth small tetrahedron 54 is fitted in the remaining space in the case interior 105, with the yellow first face 54a abutting against the yellow fourth face 48d of the fourth icosahedron 48, the yellow second face 54b resting on the yellow eighth face 44h of the icosahedron 44, the light green third face 54c abutting against the light green second face 60b of the sixth large tetrahedron 60 and the blue fourth face 54d facing the case door 106 of the tetrahedron case 101. Finally, the case door 106 of the tetrahedron case 101 is closed.

As illustrated in FIGS. 1 and 2 of the drawings, when the polyhedron blocks are assembled into the icosahedron 43 according to the foregoing description, each face of the icosahedron 43 is bordered by the same color. For example, the front face 43a, corresponding to the case door 106 of the tetrahedron case 101, is bordered by the yellow third face 58c of the fourth large tetrahedron 58, the yellow third face 59c of the fifth large tetrahedron 59 and the yellow fourth face 60d of the sixth large tetrahedron 60. Likewise, the right face 43b, corresponding to the right wall 103 of the tetrahedron case 101, is bordered by the orange first face 56a of the second large tetrahedron 56, the orange third face 57c of the third large tetrahedron 57 and the orange second face 59b of the fifth large tetrahedron 59. Furthermore, the faces of all small tetrahedra on each face of the icosahedron 43 have the same color. For example, on the front face 43a of the icosahedron 43, the blue fourth face 51d of the third small tetrahedron 51, the blue fourth face 52d of the fourth small tetrahedron 52 and the blue fourth face 54d of the sixth small tetrahedron 54 appear. At an intermediate level of difficulty in assembling the icosahedron 43, the polyhedron blocks are assembled in the tetrahedron case 101 to form the above-described color pattern on each face of the icosahedron 43, but without regard to matching colors of abutting faces of adjacent polyhedron blocks. At an elementary level of difficulty of assembling the icosahedron 43, the polyhedron blocks are placed in the tetrahedron case 101 in the same orientations as described above, except without regard to matching colors of abutting surfaces on adjacent polyhedron blocks or formation of the prescribed color pattern, as heretofore described with respect to assembly of the octahedron 3 and dual tetrahedron 30, respectively. It is understood that each color on the respective faces of each polyhedron block can be substituted by a color other than those described above, with the same color on different faces substituted by the same color. Accordingly, matching colors of abutting faces on adjacent polyhedron blocks according to the advanced level of difficulty described above would provide the same degree of difficulty in assembling the icosahedron 43, as well as the prescribed color pattern formation on each face of the icosahedron 43.

Referring next to FIGS. 6-6D of the drawings, the cuboctahedron 63 is assembled from multiple polyhedron blocks in a second tetrahedron case 101 (FIG. 2) according to an advanced, intermediate or elementary level of difficulty, as



hereinafter described. The cubocta tetra **63** includes a cuboctahedron **64**, illustrated in unfolded configuration in FIG. **6B** and including fourteen faces designated by reference numerals **64a–64n**, respectively. The cuboctahedron **64** is constructed from the unfolded configuration by folding along the fold lines **134b** and joining the face edges **134a** of adjacent faces to form the cuboctahedron illustrated in FIG. **6A**, according to the knowledge of those skilled in the art. The proportion of the length of each edge of the tetrahedron case **101** to the length of each of the face edges **134a** and fold lines **134b**, is 1:0.25.

The cubocta tetra **63** further includes a first square pyramid **65**, illustrated in unfolded configuration in FIG. **6C** and having a first face **65a**, a second face **65b**, a third face **65c**, a fourth face **65d** and a fifth face **65e**. The first square pyramid **65** is constructed from the unfolded configuration by folding along the fold lines **135b** and joining the face edges **135a** of adjacent faces to form the first square pyramid **65** illustrated in FIG. **6**. The proportion of the length of each edge of the tetrahedron case **101** to the length of each of the face edges **135a** and fold lines **135b**, is 1:0.25. The cubocta tetra **63** also includes a second square pyramid **66**, a third square pyramid **67**, a fourth square pyramid **68**, a fifth square pyramid **69** and a sixth square pyramid **70**, each of which has the same configuration and dimensions as the first square pyramid **65** described above with respect to FIG. **6C**.

The cubocta tetra **63** still further includes a first pentahedron **71**, illustrated in unfolded configuration in FIG. **6D** and having a first face **71a**, a second face **71b**, a third face **71c**, a fourth face **71d** and a fifth face **71e**. The first pentahedron **71** is constructed from the unfolded configuration by folding along the fold lines **136c** and joining the long face edges **136b** and short face edges **136a** to form the first pentahedron **71** illustrated in FIG. **6**. The proportion of the length of each face of the tetrahedron case **101** to the length of each of the short face edges **136a**, the long face edges **136b** and the fold lines **136c**, is 1:0.25, 1:0.50, and 1:0.25, respectively. The cubocta tetra **63** also includes a second pentahedron **72**, a third pentahedron **73**, a fourth pentahedron **74**, a fifth pentahedron **75**, a sixth pentahedron **76**, a seventh pentahedron **77** and an eighth pentahedron **78**, each of which has the same configuration and dimensions as the first pentahedron **71** described above with respect to FIG. **6D**.

Referring again to FIGS. **1–3** and particularly to FIGS. **6** and **6a** of the drawings, at an advanced level of difficulty in assembling the cubocta tetra **63** inside a third transparent tetrahedron case **101** according to one of several possible methods, the first pentahedron **71** is initially fitted in the case interior **105** at a vertex **101a** of the open tetrahedron case **101**. The purple first face **71a** rests on the bottom wall **104**, the green second face **71b** abuts against the right wall **103** and the blue third face **71c** against the left wall **102** of the tetrahedron case **101**. The second pentahedron **72** is next fitted in the case interior **105**, with the purple first face **72a** resting on the bottom wall **104** and the blue second face **72b** abutting against the left wall **102** and the green third face **72c** against the right wall **103** of the tetrahedron case **101**. The light green fourth face **72d** rests against the light green fourth face **71d** of the first pentahedron **71**. The first square pyramid **65** is then placed in the case interior **105**, with the green first face **65a** abutting against the left wall **102** and the green second face **65b** resting on the bottom wall **104** of the tetrahedron case **101**. The light green third face **65c** abuts against the light green fifth face **72e** of the second pentahedron **72**. The second square pyramid **66** is then placed in the case interior **105**, with the blue first face **66a** abutting against the right wall **103** and the blue second face **66b**

resting on the bottom wall **104** of the tetrahedron case **101**. The light green third face **66c** abuts against the light green fifth face **71e** of the first pentahedron **71**. The cuboctahedron **64** (FIG. **6A**) is next placed in the case interior **105**, with the light green first face **64a** abutting against the left wall **102**, the light green second face **64b**, against the right wall **103**, the light green third face **64c** resting on the bottom wall **104** and the light green fourth face **64d** facing the case door **106** of the tetrahedron case **101**. The light green fifth face **64e** of the cuboctahedron **64** rests against the light green fifth face **72e** of the second pentahedron **72**, the blue sixth face **64f** against the blue fourth face **65d** of the first square pyramid **65** and the purple seventh face **64g** against the purple fourth face **66d** of the second square pyramid **66**. The third square pyramid **67** is next placed in the case interior **105**, with the purple first face **67a** abutting against the left wall **102** and the purple second face **67b** against the right wall **103** of the tetrahedron case **101**. The green third face **67c** rests against the green eighth face **64h** of the cuboctahedron **64** and the light green fourth face **67d** rests on the light green fifth face **72e** of the second pentahedron **72**. The third pentahedron **73** is next placed in the case interior **105** at another vertex **101a** thereof with the blue first face **73a** resting on the bottom wall **104**, the purple second face **73b** abutting against the left wall **102** and the third green face **73c** facing the case door **106** of the tetrahedron case **101**. The fourth pentahedron **74** is next placed in the case interior **105**, with the blue first face **74a** resting on the bottom wall **104**, the green second face **74b** facing the case door **106** and the purple third face **74c** abutting against the left wall **102** of the tetrahedron case **101**. The blue fourth face **74d** rests on the blue fourth face **73d** of the third pentahedron **73** and the light green fifth face **74e** against the light green ninth face **64i** of the cuboctahedron **64** and the light green fifth face **65e** of the first square pyramid **65**. The fourth square pyramid **68** is then placed in the case interior **105**, with the blue first face **68a** abutting against the left wall **102** and the blue second face **68b**, facing the case door **106** of the tetrahedron case **101**. The purple third face **68c** rests against the purple tenth face **64j** of the cuboctahedron **64** and the light green fourth face **68d** rests on the light green fifth face **74e** of the fourth pentahedron **74**. The fifth square pyramid **69** is then placed between the fourth pentahedron **74** and the cuboctahedron **64**, with the purple first face **69a** resting on the bottom wall **104** and the purple second face **69b** facing the case door **106** of the tetrahedron case **101**. The light green third face **69c** rests against the light green fifth face **73e** of the third pentahedron **73** and the green fourth face **69d** abuts against the green eleventh face **64k** of the cuboctahedron **64**. The fifth pentahedron **75** is next placed in the case interior **105** at another vertex **101a** thereof with the green first face **75a** resting on the bottom wall **104**, the purple second face **75b** abutting against the right wall **103** and the blue third face **75c** facing the case door **106** of the tetrahedron case **101**. The light green fourth face **75d** abuts against the light green fifth face **69e** of the fifth square pyramid **69**, the light green twelfth face **64l** of the cuboctahedron **64** and the light green fifth face **66e** of the second square pyramid **66**. The sixth pentahedron **76** is then placed in the case interior **105**, with the green first face **76a** resting on the bottom wall **104**, the purple second face **76b** abutting against the right wall **103** and the blue third face **76c** facing the case door **106** of the tetrahedron case **101**. The purple fourth face **76d** rests against the purple fifth face **75e** of the fifth pentahedron **75**. The sixth square pyramid **70** is next fitted in the case interior **105**, with the green first face **70a** abutting against the right wall **103** and the green second face **70b** facing the case door



106 of the tetrahedron case 101. The blue third face 70c rests against the blue thirteenth face 64m of the cuboctahedron 64 and the light green fourth face 70d, against the light green fifth face 76e of the sixth pentahedron 76. The seventh pentahedron 77 is next placed in the case interior 105, with the blue first face 77a abutting against the right wall 103, the green second face 77b, against the left wall 102 and the purple third face 77c facing the case door 106 of the tetrahedron case 101. The light green fourth face 77d rests on the light green fifth face 70e of the sixth square pyramid 70, the light green fourteenth face 64n of the cuboctahedron 64 and the light green fifth face 67e of the third square pyramid 67. To complete assembly of the cubocta small tetrahedron 63 in the tetrahedron case 101, the eighth pentahedron 78 is placed in the remaining space in the case interior 105 at the remaining vertex 101a thereof with the blue first face 78a abutting against the right wall 103 and the green second face 78b abutting against the left wall 102 and the purple third face 78c facing the case door 106 of the tetrahedron case 101. The light green fourth face 78d rests on the light green fifth face 68e of the fourth square pyramid 68 and the green fifth face 78e rests against the green fifth face 77e of the seventh pentahedron 77. Finally, the case door 106 of the tetrahedron case 101 is closed.

As illustrated in FIGS. 1 and 2 of the drawings, when the polyhedron blocks are assembled into the cubocta tetra 63 according to the foregoing description, each of the three vertices on each face of the cubocta tetra 30 is one of three colors. For example, on the front face 63a of the cubocta tetra 63, corresponding to the case door 106 of the tetrahedron case 101, the vertex formed by the third face 73c of the third pentahedron 73 and second face 74b of the fourth pentahedron 74, is green; the vertex formed by the third face 75c of the fifth pentahedron 75 and third face 76c of the sixth pentahedron 76, is blue; and the vertex formed by the third face 77c of the seventh pentahedron 77 and third face 78c of the eighth pentahedron 78, is purple. Furthermore, the three faces of the respective square pyramids on each face of the cubocta tetra 63 are three different colors. On the front face 63a of the cubocta tetra 63, for example, the second face 68b of the fourth square pyramid 68 is blue, the second face 69b of the fifth square pyramid 69 is purple and the second face 70b of the sixth square pyramid 70 is green. As in the cases with respect to the octahedron 3, dual tetra 30 and icosa tetra 43, respectively, described above, at an intermediate level of difficulty in assembling the cubocta tetra 63, the polyhedron blocks are assembled in the tetrahedron case 101 to form the color pattern described above on each face of the cubocta tetra 63, but without regard to matching colors of abutting faces of adjacent polyhedron blocks. At an elementary level of difficulty in assembling the cubocta tetra 63 from the constituent polyhedron blocks, the cubocta tetra 63 is assembled in the tetrahedron case 101 without regard to matching colors of abutting faces on adjacent polyhedron blocks or color pattern formation on the respective faces of the cubocta tetra 63. It is understood that each color on the respective faces of each polyhedron block can be substituted by a color other than those described above, with the same color on different faces substituted by the same color. Such color substitution would provide the same degree of difficulty in assembling the cubocta tetra 63, as well as the prescribed color pattern formation on each face of the cubocta tetra 63, when the cubocta tetra 63 is assembled according to the advanced level of difficulty described above.

Referring now to FIGS. 7-7C of the drawings, the T-tetra 80 is assembled from multiple polyhedron blocks in a fourth

tetrahedron case 101 (FIG. 2) according to an advanced, intermediate or elementary level of difficulty, as hereinafter described. The T-tetra 80 includes a first T-tetrahedron 97, illustrated in unfolded configuration in FIG. 7A and including a base or first face 97a, a second face 97b, a third face 97c and a fourth face 97d. The first T-tetrahedron 97 is constructed from the unfolded configuration by folding along the fold lines 138c and base fold line 138d and joining the base edges 138a and face edges 138b to form the first T-tetrahedron 97 illustrated in FIG. 7. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the base edges 138a, face edges 138b, fold lines 138c and base fold line 138d, is 1:0.3333, 1:0.3908, 1:0.3908, and 1:0.3333, respectively. The T-tetra 80 includes a second T-tetrahedron 98, a third T-tetrahedron 99, and a fourth T-tetrahedron 100, each of which has the same configuration and dimensions as the first T-tetrahedron 97 described above with respect to FIG. 7A.

The T-tetra 80 further includes a first T-tri pyramid 81, illustrated in the unfolded configuration in FIG. 7B and including a first face 81a, a second face 81b, a third face 81c and a fourth face 81d. The first T-tri pyramid 81 is constructed from the unfolded configuration by folding along the fold lines 139b and joining the face edges 139a of adjacent faces to form the first T-tri pyramid 81 illustrated in FIG. 7. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the face edges 139a and fold lines 139b, is 1:0.3333. The T-tetra 80 includes a second T-tri pyramid 82, a third T-tri pyramid 83 and a fourth T-tri pyramid 84, each of which has the same configuration and dimensions as the first T-tri pyramid 81 described above with respect to FIG. 7B. The T-tetra 80 still further includes a first T-pentahedron 85, illustrated in unfolded configuration in FIG. 7c and including a first face 85a, a second face 85b, a third face 85c, a fourth face 85d and a fifth face 85e. The first T-pentahedron 85 is constructed from the unfolded configuration by folding along the fold lines 140d and joining the respective side edges 140b, the front edges 140a and the rear edges 140c, to form the first T-pentahedron 85 illustrated in FIG. 7. The proportion of the length of each edge of the tetrahedron case 101 to the length of each of the front edges 140a, the side edges 140b, the rear edges 140c and the fold lines 140d is 1:0.2154, 1:0.3908, 1:0.3908 and 1:0.3333, respectively. The T-tetra 80 also includes a second T-pentahedron 86, a third T-pentahedron 87, a fourth T-pentahedron 88, a fifth T-pentahedron 89, a sixth T-pentahedron 90, a seventh T-pentahedron 91, an eighth T-pentahedron 92, a ninth T-pentahedron 93, a tenth T-pentahedron 94, an eleventh T-pentahedron 95 and a twelfth T-pentahedron 96, each of which has the same configuration and dimensions as the first T-pentahedron 85 described above with respect to FIG. 7c.

Referring again to FIGS. 1-3 and particularly to FIG. 7 of the drawings, at an advanced level of difficulty in assembling the truncated tetra 80 in a fourth tetrahedron case 101 and according to one of several possible methods, the first T-tri pyramid 81 is initially placed in the case interior 105 at a vertex 101a thereof with the green first face 81a abutting against the left wall 102, the green bottom or second face 81b resting on the bottom wall 104 and the green third face 81c abutting against the right wall 103 of the tetrahedron case 101. The first T-pentahedron 85 is next fitted in the case interior 105, in bordering relationship to the first T-tri pyramid 81, with the red bottom or first face 85a resting on the bottom wall 104 of the tetrahedron case 101. The second T-pentahedron 86 is then placed in the case interior 105, with the blue first face 86a resting on the bottom wall 104 of the



tetrahedron case **101** and the green second face **86b** abutting against the green second face **85b** of the first T-pentahedron **85**. The third T-pentahedron **87** is then placed in the case interior **105**, with the yellow bottom or first face **87a** resting on the bottom wall **104** of the tetrahedron case **101**, the green second face **87b** abutting against the green third face **86c** of the second T-pentahedron **86** and the green third face **87c** abutting against the green third face **85c** of the first T-pentahedron **85**. The first T-tetrahedron **97** is next placed in the case interior **105**, with the green first face **97a** abutting against the green fourth face **81d** of the first T-tripyramid **81** and the yellow second face **97b** resting on the yellow fourth face **85d** of the first T-pentahedron **85**. The fourth T-pentahedron **88** is next placed in the case interior **105**, with the yellow first face **88a** abutting against the left wall **102** of the tetrahedron case **101**. The red second face **88b** abuts against the red fourth face **87d** of the third T-pentahedron **87** and the blue third face **88c** rests against the blue third face **97c** of the first T-tetrahedron **97**. The fifth T-pentahedron **89** is then placed in the case interior **105**, with the blue first face **89a** resting against the right wall **103** of the tetrahedron case **101** and the red second face **89b** resting against the red fourth face **97d** of the first T-tetrahedron **97**. The second T-tripyramid **82** is fitted in the case interior **105** at another vertex **101a** thereof, with the green first face **82a** facing the case door **106**, the green second face **82b** abutting against the left wall **102** and the green bottom or third face **82c** resting on the bottom wall **104** of the tetrahedron case **101**. The second T-tetrahedron **98** is next placed in the case interior **105**, with the green first face **98a** abutting against the green fourth face **82d** of the second T-tripyramid **82** and the blue second face **98b** resting on the blue fifth face **87e** of the third T-pentahedron **87**. The sixth T-pentahedron **90** is then placed in the case interior **105**, with the red first face **90a** abutting against the left wall **102** of the tetrahedron case **101**. The yellow second face **90b** rests against the yellow third face **98c** of the second T-tetrahedron **98** and the green third face **90c** abuts against the green fourth face **88d** of the fourth T-pentahedron **88**. The third T-tripyramid **83** is then placed in the case interior **105** at another vertex **101a** thereof with the green first face **83a** facing the case door **106**, the green second face **83b** abutting against the right wall **103** and the green bottom or third face **83c** resting on the bottom wall **104** of the tetrahedron case **101**. The third T-tetrahedron **99** is next placed in the case interior **105**, with the green first face **99a** resting against the green fourth face **83d** of the third T-tripyramid **83** and the red second face **99b** resting on the red fourth face **86d** of the second pentahedron **86**. The seventh T-pentahedron **91** is next placed inside the case interior **105**, with the red first face **91a** resting abutting against the right wall **103** of the tetrahedron case **101**. The yellow second face **91b** rests against the yellow third face **99b** of the third T-tetrahedron **99**, the blue third face **91e**, against the blue fifth face **85e** of the first T-pentahedron **85** and the green fourth face **91c**, against the green third face **89b** of the fifth T-pentahedron **89**. The eighth T-pentahedron **92** is next placed in the case interior **105**, with the blue first face **92a** abutting against the left wall **102** of the tetrahedron case **101**. The green second face **92b** rests against the green fourth face **90c** of the sixth T-pentahedron **90**, the green third face **92c** rests on the green fifth face **88b** of the fourth T-pentahedron **88** and the yellow fourth face **92e** abuts against the yellow fifth face **89e** of the fifth T-pentahedron **89**. The ninth T-pentahedron **93** is then placed in the case interior **105**, with the yellow first face **93a** abutting against the right wall **103** of the tetrahedron case **101**. The green second face **93b** rests on the green fourth face **89c** of the fifth

T-pentahedron **89** and the green third face **93c** rests on the green fifth face **91b** of the seventh T-pentahedron **91**. The tenth T-pentahedron **94** is next placed in the case interior **105**, with the blue first face **94a** facing the case door **106** of the tetrahedron case **101**. The red second face **94d** abuts against the red fourth face **98d** of the second T-tetrahedron **98** and the yellow third face **94e**, against the yellow fifth face **86e** of the second T-pentahedron **86**. The eleventh T-pentahedron **95** is next placed in the case interior **105**, with the yellow first face **95a** facing the case door **106** of the tetrahedron case **101**. The blue second face **95d** abuts against the blue fourth face **99c** of the third T-tetrahedron **99**, the red third face **95e** against the red fourth face **93e** of the seventh T-pentahedron **93** and the green fourth face **95b** against the green fourth face **94c** of the tenth T-pentahedron **94**. The twelfth pentahedron **96** is next placed in the case interior **105**, with the red first face **96a** facing the case door **106** of the tetrahedron case **101**. The blue second face **96e** abuts against the blue fifth face **90e** of the sixth T-pentahedron **90**, the green third face **96b** against the green fifth face **95c** of the eleventh T-pentahedron **95** and the green fourth face **96c** against the green fifth face **94b** of the tenth T-pentahedron **94**. The inverted, fourth T-tetrahedron **100** is next placed in the case interior **105**, with the blue first face **100c** resting against the blue fifth face **93d** of the ninth T-pentahedron **93**, the yellow second face **100b**, against the yellow fifth face **96d** of the twelfth T-pentahedron **96** and the red third face **100d** against the red fifth face **92d** of the eighth T-pentahedron **92**. Finally, to complete assembly of the truncated tetra **80** in the tetrahedron case **101**, the fourth T-tripyramid **84** is fitted in the remaining space in the case interior **105** at the remaining vertex **101a** thereof with the green first face **84a** facing the case door **106**, the green second face **84b** abutting against the left wall **102** and the green third face **84c** against the right wall **103** of the tetrahedron case **101**. The green bottom or fourth face **84d** rests on the green top or fourth face **100a** of the fourth T-tetrahedron **100**.

As illustrated in FIGS. 1 and 2 of the drawings, when the polyhedron blocks are assembled in the truncated tetra **80** according to the foregoing description, each vertex of the truncated tetra **80** formed by the first, second, third and fourth T-tripyramids, respectively, is green in color. Furthermore, the faces of the three T-pentahedra on each face of the truncated small tetrahedron are red, yellow and blue, respectively. For example, on the front face **80a** of the truncated tetra **80** corresponding to the case door **106** of the tetrahedron case **101**, the first face **94a** of the tenth T-pentahedron **94a** is blue, the first face **95a**; of the eleventh T-pentahedron **95** is yellow and the first face **96a** of the twelfth pentahedron **96** is red. As described above with respect to the octahedron **3**, the dual tetra **30**, the icos tetra **43** and the cubocta tetra **63**, at an intermediate level of difficulty in assembling the truncated tetra **80**, the polyhedron blocks are assembled in the tetrahedron case **101** to form the above-described, four-color pattern on each face of the truncated tetra **80**, but without regard to matching colors of abutting faces of adjacent polyhedron blocks. At an elementary level of difficulty in assembling the truncated tetra **80**, the polyhedron blocks are assembled in the tetrahedron case **101** without regard to matching colors of abutting surfaces on adjacent polyhedron blocks or formation of the above-described color pattern formation on each face of the truncated tetra **80**. It is understood that each color on the respective faces of each polyhedron blocks can be substituted by a color other than those described above, with the same color on different faces substituted by the same



color. As described above with respect to the octahedron **3**, the dual tetra **30**, the icosa tetra **43** and the cubocta tetra **63**, such color substitution would provide the same degree of difficulty in assembling the truncated tetra **80**, as well as the prescribed color pattern formation on each face of the truncated tetra **80**, when the truncated tetra **80** is assembled according to the advanced level of difficulty described above.

It will be appreciated by those skilled in the art that the above descriptions of assembling the octahedron **3**, dual tetra **30**, icosa tetra **43**, cubocta tetra **63** and truncated tetra **80**, respectively, according to the advanced level of difficulty, represents only one of several possible solutions to solving the puzzles **1**. Assembly of each of the octahedron **3** or tetrahedra according to the advanced level of difficulty and formation of the prescribed color pattern on the respective faces of the octahedron **3** or tetrahedron, can be accomplished by any method of placing the constituent polyhedron blocks in the respective octahedron case **108** or tetrahedron case **101**, in the same orientations described above, and in which abutting faces of adjacent polyhedron blocks match in color. It will be further appreciated by those skilled in the art that the polyhedron blocks of the octahedron **3** or each of the tetrahedra can be constructed from wood, molded plastic or any other lightweight, durable material, according to the knowledge of those skilled in the art.

While the preferred embodiments of the invention have been described above, it will be recognized and understood that various modifications may be made in the invention and the appended claims are intended to cover all such modifications which may fall within the spirit and scope of the invention.

Having described my invention with the particularity set forth above, what is claimed is:

**1.** A multi-polyhedral puzzle comprising an octahedron having eight octahedron faces, said octahedron comprising an octahedron set of polyhedron blocks including a central cube inscribed in said octahedron, said central cube having eight block corners, whereby said block corners of said central cube meet said eight octahedron faces, respectively; and each of said octahedron set of polyhedron blocks having a plurality of block faces each having one of a plurality of colors, wherein block faces of each of said polyhedron blocks are disposed in facing relationship to block faces of adjacent ones of said polyhedron blocks to define said octahedron and said block faces disposed in facing relationship define a pair of block faces on respective adjacent ones of said polyhedron blocks, and said pair of block faces can selectively be matched in color to define a prescribed color pattern on each of said eight octahedron faces of said octahedron.

**2.** The multi-polyhedral puzzle of claim **1** wherein said octahedron set of polyhedron blocks further comprises:

- (a). a first irregular tetrahedron;
- (b). a second irregular tetrahedron provided in bordering relationship to said first irregular tetrahedron;
- (c). a third irregular tetrahedron provided in bordering relationship to said second irregular tetrahedron;
- (d). a fourth irregular tetrahedron provided in bordering relationship to said first irregular tetrahedron and said third irregular tetrahedron;
- (e). a bottom tetrapyramid cradled in inverted position between said first irregular tetrahedron, said second irregular tetrahedron, said third irregular tetrahedron and said fourth irregular tetrahedron, with block faces of said bottom tetrapyramid disposed in facing relation-

ship to block faces of said first, second, third and fourth irregular tetrahedra, respectively;

- (f). a fifth irregular tetrahedron provided in bordering relationship with said third irregular tetrahedron and said fourth irregular tetrahedron;
- (g). a left rear tetrapyramid provided above said fourth irregular tetrahedron and adjacent to said fifth irregular tetrahedron, with block faces of said left rear tetrapyramid disposed in facing relationship to block faces of said fourth irregular tetrahedron and said fifth irregular tetrahedron, respectively;
- (h). a right rear tetrapyramid provided above said third irregular tetrahedron and adjacent to said fifth irregular tetrahedron, opposite said left rear tetrapyramid, with block faces of said right rear tetrapyramid disposed in facing relationship to block faces of said third irregular tetrahedron and said fifth irregular tetrahedron, respectively, and with block faces of said central cube disposed in facing relationship to block faces of said left rear tetrapyramid and said right rear tetrapyramid, respectively;
- (i). a sixth irregular tetrahedron provided in bordering relationship to said first irregular tetrahedron and said fourth irregular tetrahedron, with a block face of said sixth irregular tetrahedron disposed in facing relationship to a block face of said left rear tetrapyramid;
- (j). a seventh irregular tetrahedron provided in bordering relationship to said second irregular tetrahedron and said third irregular tetrahedron, with a block face of said seventh irregular tetrahedron disposed in facing relationship to a block face of said right rear tetrapyramid;
- (k). a left front tetrapyramid provided above said first irregular tetrahedron, with block faces of said left front tetrapyramid disposed in facing relationship to block faces of said first irregular tetrahedron, said sixth irregular tetrahedron and said octahedron cube;
- (l). a right front tetrapyramid provided above said second irregular tetrahedron, with block faces of said right front tetrapyramid disposed in facing relationship to block faces of said second irregular tetrahedron, said seventh irregular tetrahedron and said octahedron cube;
- (m). an eighth irregular tetrahedron provided in bordering relationship to said first irregular tetrahedron and said second irregular tetrahedron, with block faces of said eighth irregular tetrahedron disposed in facing relationship to block faces of said left front tetrapyramid and said right front tetrapyramid, respectively;
- (n). a ninth irregular tetrahedron provided above said left rear tetrapyramid and in bordering relationship to said fifth irregular tetrahedron and said sixth irregular tetrahedron, with a block face of said ninth irregular tetrahedron disposed in facing relationship to a block face of said left rear tetrapyramid;
- (o). a tenth irregular tetrahedron provided above said right rear tetrapyramid and in bordering relationship to said fifth irregular tetrahedron, said seventh irregular tetrahedron and said ninth irregular tetrahedron, with a block face of said tenth irregular tetrahedron disposed in facing relationship to a block face of said right rear tetrapyramid;
- (p). a top tetrapyramid provided above said central octahedron cube, with block faces of said top tetrapyramid disposed in facing relationship to block faces of said octahedron cube, said ninth irregular tetrahedron and said tenth irregular tetrahedron, respectively;



(q). an eleventh irregular tetrahedron provided in bordering relationship to said seventh irregular tetrahedron, said eighth irregular tetrahedron and said tenth irregular tetrahedron, with block faces of said eleventh irregular tetrahedron disposed in facing relationship to block faces of said top tetrapyramid and said right front tetrapyramid, respectively; and

(r). a twelfth irregular tetrahedron provided in bordering relationship to said sixth irregular tetrahedron, said eighth irregular tetrahedron, said ninth irregular tetrahedron and said eleventh irregular tetrahedron, with block faces of said twelfth irregular tetrahedron disposed in facing relationship to block faces of said top tetrapyramid and said left front tetrapyramid, respectively.

**3.** A multi-polyhedral puzzle comprising a tetrahedron having four tetrahedron faces and four vertices, said tetrahedron comprising a tetrahedron set of polyhedron blocks including a regular tetrahedron inscribed in said tetrahedron, said regular tetrahedron having four regular tetrahedron vertices, whereby said regular tetrahedron vertices meet said four tetrahedron faces, respectively, of said tetrahedron; and each of said tetrahedron set of polyhedron blocks having a plurality of block faces each having one of a plurality of colors, wherein block faces of each of said polyhedron blocks are disposed in facing relationship to block faces of adjacent ones of said polyhedron blocks to define said tetrahedron and said block faces disposed in facing relationship define a pair of block faces on respective adjacent ones of said polyhedron blocks, and said pair of block faces can selectively be matched in color to define a prescribed color pattern on each of said four tetrahedron faces of said tetrahedron.

**4.** The multi-polyhedral puzzle of claim **3** wherein said tetrahedron set of polyhedron blocks comprises:

- (a). a first irregular, large tetrahedron;
- (b). a second irregular, large tetrahedron provided in contiguous relationship to said first irregular, large tetrahedron;
- (c). a rear tripyramid fitted between said first irregular, large tetrahedron and said second irregular, large tetrahedron, with block faces of said rear tripyramid disposed in facing relationship to block faces of said first irregular, large tetrahedron and said second irregular, large tetrahedron, respectively;
- (d). a third irregular, large tetrahedron provided above said rear tripyramid, with a block face of said third irregular, large tetrahedron disposed in facing relationship to a block face of said rear tripyramid;
- (e). a fourth irregular, large tetrahedron provided between said first irregular, large tetrahedron and said second irregular, large tetrahedron;
- (f). a left tripyramid provided between said first irregular, large tetrahedron and said fourth irregular, large tetrahedron, with block faces of said left tripyramid disposed in facing relationship to block faces of said first irregular, large tetrahedron and said fourth irregular, large tetrahedron, respectively;
- (g). a right tripyramid provided between said second irregular, large tetrahedron and said fourth irregular, large tetrahedron, with block faces of said right tripyramid disposed in facing relationship to block faces of said second irregular, large tetrahedron and said fourth irregular, large tetrahedron, respectively, and with said regular tetrahedron fitted between said left tripyramid and said right tripyramid and block faces of said regular

tetrahedron disposed in facing relationship to block faces of said rear tripyramid, said left tripyramid and said right tripyramid, respectively;

(h). a top tripyramid provided above said regular tetrahedron, with block faces of said top tripyramid disposed in facing relationship to block faces of said regular tetrahedron and said third irregular, large tetrahedron, respectively;

(i). a fifth irregular, large tetrahedron fitted adjacent to said fourth irregular, large tetrahedron, with block faces of said fifth irregular, large tetrahedron disposed in facing relationship to block faces of said top tripyramid and said left tripyramid, respectively; and

(j). a sixth irregular, large tetrahedron fitted adjacent to said fifth irregular, large tetrahedron, with block faces of said sixth irregular, large tetrahedron disposed in facing relationship to block faces of said top tripyramid and said right tripyramid, respectively.

**5.** A multi-polyhedral puzzle comprising a tetrahedron having four tetrahedron faces and four vertices, said tetrahedron comprising a tetrahedron set of polyhedron blocks, each of said tetrahedron set of polyhedron blocks having a plurality of block faces each having one of a plurality of colors, wherein block faces of each of said polyhedron blocks are disposed in facing relationship to block faces of adjacent ones of said polyhedron blocks to define said tetrahedron and said block faces disposed in facing relationship define a pair of block faces on respective adjacent ones of said polyhedron blocks, and said pair of block faces can selectively be matched in color to define a prescribed color pattern on each of said four tetrahedron faces of said tetrahedron; and wherein said tetrahedron set of polyhedron blocks includes an icosahedron inscribed in said tetrahedron, whereby four block faces of said icosahedron appear on said four tetrahedron faces, respectively, of said tetrahedron.

**6.** The multi-polyhedral puzzle of claim **5** wherein said tetrahedron set of polyhedron blocks comprises:

- (a). a first large tetrahedron;
- (b). a second large tetrahedron provided in said tetrahedron in spaced relationship to said first large tetrahedron;
- (c). a first icosahedron fitted in said tetrahedron, with a block face of said first icosahedron disposed in facing relationship to a block face of said second large tetrahedron;
- (d). a first small tetrahedron provided adjacent to said first icosahedron, with block faces of said first small tetrahedron disposed in facing relationship to block faces of said first icosahedron and said first large tetrahedron, respectively;
- (e). a third large tetrahedron provided above said first icosahedron, with a block face of said third large tetrahedron disposed in facing relationship to a block face of said first icosahedron;
- (f). a second small tetrahedron provided adjacent to said second large tetrahedron, with a block face of said second small tetrahedron disposed in facing relationship to a block face of said second large tetrahedron and block faces of said icosahedron disposed in facing relationship to block faces of said first small tetrahedron, said icosahedron, said second large tetrahedron, said second small tetrahedron and said first large tetrahedron, respectively;
- (g). a second icosahedron fitted between said first large tetrahedron and said icosahedron, with block faces of



said second icosahedron disposed in facing relationship to block faces of said icosahedron and said first large tetrahedron, respectively,

- (h). a fourth large tetrahedron fitted in said tetrahedron, with a block face of said fourth large tetrahedron disposed in facing relationship to a block face of said icosahedron;
- (i). a third icosahedron provided between said second small tetrahedron and said icosahedron, with block faces of said third icosahedron disposed in facing relationship to said block faces of said icosahedron, said second small tetrahedron and said fourth large tetrahedron, respectively;
- (j). a third small tetrahedron fitted between said second icosahedron and said fourth large tetrahedron, with said block faces of said third small tetrahedron disposed in facing relationship to block faces of said second icosahedron, said icosahedron and said fourth large tetrahedron, respectively;
- (k). a fifth large tetrahedron fitted in said tetrahedron, with a block face of said fifth large tetrahedron disposed in facing relationship to a block face of said icosahedron;
- (l). a fourth small tetrahedron provided between said icosahedron and said third icosahedron, with block faces of said fourth small tetrahedron disposed in facing relationship to block faces of said icosahedron, said third icosahedron and said fifth large tetrahedron, respectively;
- (m). a fifth small tetrahedron fitted between said third large tetrahedron and said icosahedron, with block faces of said fifth small tetrahedron disposed in facing relationship to block faces of said icosahedron and said third large tetrahedron, respectively;
- (n). a fourth icosahedron provided between said fifth large tetrahedron and said icosahedron, with block faces of said fourth icosahedron disposed in facing relationship to block faces of said icosahedron, said fifth large tetrahedron and said fifth small tetrahedron, respectively;
- (o). a sixth large tetrahedron provided in said tetrahedron, with block faces of said sixth large tetrahedron disposed in facing relationship to block faces of said second icosahedron and said icosahedron, respectively; and
- (p). a sixth small tetrahedron fitted between said sixth large tetrahedron and said icosahedron, with block faces of said sixth small tetrahedron disposed in facing relationship to block faces of said fourth icosahedron, said icosahedron and said sixth large tetrahedron, respectively.

7. A multi-polyhedral puzzle comprising a tetrahedron having four tetrahedron faces and four vertices, said tetrahedron comprising a tetrahedron set of polyhedron blocks, each of said tetrahedron set of polyhedron blocks having a plurality of block faces each having one of a plurality of colors, wherein block faces of each of said polyhedron blocks are disposed in facing relationship to block faces of adjacent ones of said polyhedron blocks to define said tetrahedron and said block faces disposed in facing relationship define a pair of block faces on respective adjacent ones of said polyhedron blocks, and said pair of block faces can selectively be matched in color to define a prescribed color pattern on each of said four tetrahedron faces of said tetrahedron; and wherein said tetrahedron set of polyhedron blocks includes a cuboctahedron inscribed in said tetrahedron, whereby four block faces of said cuboctahedron appear on said four tetrahedron faces, respectively, of said tetrahedron.

8. The multi-polyhedral puzzle of claim 7 wherein said tetrahedron set of polyhedron blocks comprises:

- (a). a first pentahedron provided in said tetrahedron at a first vertex of said tetrahedron;
- (b). a second pentahedron provided adjacent to said first pentahedron, with a block face of said second pentahedron disposed in facing relationship to a block face of said first pentahedron;
- (c). a first square pyramid fitted adjacent to said second pentahedron, with a block face of said first square pyramid disposed in facing relationship to a block face of said second pentahedron;
- (d). a second square pyramid provided adjacent to said first pentahedron, with a block face of said second square pyramid disposed in facing relationship to a block face of said first pentahedron and block faces of said cuboctahedron disposed in facing relationship to block faces of said second pentahedron, said first square pyramid and said second square pyramid, respectively;
- (e). a third square pyramid provided adjacent to said cuboctahedron, with block faces of said third square pyramid disposed in facing relationship to block faces of said cuboctahedron and said second pentahedron, respectively;
- (f). a third pentahedron fitted in said tetrahedron at a second vertex of said tetrahedron;
- (g). a fourth pentahedron provided adjacent to said third pentahedron, with a block face of said fourth pentahedron disposed in facing relationship to a block face of said third pentahedron, and a block face of said fourth pentahedron disposed in facing relationship to block faces of said cuboctahedron and said first square pyramid;
- (h). a fourth square pyramid fitted between said fourth pentahedron and said cuboctahedron, with block faces of said fourth square pyramid disposed in facing relationship to block faces of said cuboctahedron and said fourth pentahedron, respectively;
- (i). a fifth square pyramid fitted between said fourth pentahedron and said cuboctahedron, with block faces of said fifth square pyramid disposed in facing relationship to block faces of said third pentahedron and said cuboctahedron, respectively;
- (j). a fifth pentahedron provided in said tetrahedron at a third vertex of said tetrahedron, with a block face of said fifth pentahedron disposed in facing relationship to block faces of said fifth square pyramid, said cuboctahedron and said second square pyramid;
- (k). a sixth pentahedron provided adjacent to said fifth pentahedron, with a block face of said sixth pentahedron disposed in facing relationship to a block face of said fifth pentahedron;
- (l). a sixth square pyramid fitted between said sixth pentahedron and said cuboctahedron, with block faces of said sixth square pyramid disposed in facing relationship to block faces of said cuboctahedron and said sixth pentahedron, respectively;
- (m). a seventh pentahedron provided above said cuboctahedron, with a block face of said seventh pentahedron disposed in facing relationship to block faces of said sixth square pyramid, said cuboctahedron and said third square pyramid; and
- (n). an eighth pentahedron fitted adjacent to said seventh pentahedron at a fourth vertex of said tetrahedron, with



block faces of said eighth pentahedron disposed in facing relationship to block faces of said fourth square pyramid and said seventh pentahedron, respectively.

9. A multi-polyhedral puzzle comprising a tetrahedron having four tetrahedron faces and four vertices, said tetrahedron comprising a tetrahedron set of polyhedron blocks each having a plurality of block faces each having one of a plurality of colors, wherein block faces of each of said polyhedron blocks are disposed in facing relationship to block faces of adjacent ones of said polyhedron blocks to define said tetrahedron, and said block faces disposed in facing relationship define a group of block faces on respective adjacent ones of said polyhedron blocks and said group of block faces can selectively be matched in color to define a prescribed color pattern on each of said four tetrahedron faces, said tetrahedron set of polyhedron blocks comprising:
- (a). a first T-tri pyramid provided in said tetrahedron at a first vertex of said tetrahedron;
  - (b). a first T-pentahedron provided in bordering relationship to said first T-tri pyramid;
  - (c). a second T-pentahedron provided in adjacent relationship to said first T-pentahedron, with a block face of said second T-pentahedron disposed in facing relationship to said first T-pentahedron;
  - (d). a third T-pentahedron provided in adjacent relationship to said second T-pentahedron, with block faces of said third T-pentahedron disposed in facing relationship to block faces of said first T-pentahedron and said second T-pentahedron, respectively;
  - (e). a first T-tetrahedron provided above said first T-pentahedron, with block faces of said first T-tetrahedron disposed in facing relationship to block faces of said first T-tri pyramid and said first T-pentahedron, said first T-tetrahedron inscribed in said tetrahedron, whereby four block faces of said first T-tetrahedron appear on said four tetrahedron faces, respectively, of said tetrahedron;
  - (f). a fourth T-pentahedron provided adjacent to said third T-pentahedron and said first T-tetrahedron, with block faces of said fourth T-pentahedron disposed in facing relationship to block faces of said third T-pentahedron and said first T-tetrahedron, respectively;
  - (g). a fifth T-pentahedron provided adjacent to said first T-tetrahedron, opposite said fourth T-pentahedron, with a block face of said fifth T-pentahedron disposed in facing relationship to a block face of said first T-tetrahedron;
  - (h). a second T-tri pyramid fitted in said tetrahedron at a second vertex of said tetrahedron;
  - (i). a second T-tetrahedron provided adjacent to said second T-tri pyramid, with block faces of said second T-tetrahedron disposed in facing relationship to block faces of said second T-tri pyramid and said third T-pentahedron, respectively;
  - (j). a sixth T-pentahedron fitted between said second T-tetrahedron and said fourth T-pentahedron, with block faces of said sixth T-pentahedron disposed in facing relationship to block faces of said second T-tetrahedron and said fourth T-pentahedron, respectively;
  - (k). a sixth T-pentahedron provided above said fourth T-pentahedron, with block faces of said sixth

T-pentahedron disposed in facing relationship to block faces of second T-tetrahedron and said fourth T-pentahedron, respectively;

- (l). a third T-tri pyramid provided in said tetrahedron at a third vertex of said tetrahedron;
- (m). a third T-tetrahedron provided adjacent to said third T-tri pyramid, with block faces of said third T-tetrahedron disposed in facing relationship to block faces of said third T-tri pyramid and said second pentahedron, respectively;
- (n). a seventh T-pentahedron provided adjacent to said third T-tetrahedron, with block faces of said seventh T-pentahedron disposed in facing relationship to block faces of said third T-tetrahedron, said first T-pentahedron and said fifth T-pentahedron, respectively;
- (o). an eighth T-pentahedron fitted between said fourth T-pentahedron and said sixth T-pentahedron, with block faces of said eighth T-pentahedron disposed in facing relationship to block faces of said fourth T-pentahedron, said fifth T-pentahedron and said sixth T-pentahedron, respectively;
- (p). a ninth T-pentahedron fitted between said fifth T-pentahedron and said seventh T-pentahedron, with block faces of said ninth T-pentahedron disposed in facing relationship to block faces of said fifth T-pentahedron and said seventh T-pentahedron, respectively;
- (q). a tenth T-pentahedron provided between said second T-pentahedron and said second T-tetrahedron, with block faces of said tenth T-pentahedron disposed in facing relationship to block faces of said second T-pentahedron and said second T-tetrahedron, respectively;
- (r). an eleventh T-pentahedron fitted between said tenth T-pentahedron and said third T-tetrahedron, with block faces of said eleventh T-pentahedron disposed in facing relationship to block faces of said third T-tetrahedron, said seventh T-pentahedron and said tenth T-pentahedron, respectively;
- (s). a twelfth T-pentahedron fitted between said tenth T-pentahedron and said eleventh T-pentahedron, with block faces of said twelfth T-pentahedron disposed in facing relationship to block faces of said sixth T-pentahedron, said tenth T-pentahedron and said eleventh T-pentahedron, respectively;
- (t). a fourth T-tetrahedron fitted in inverted position between said eighth T-pentahedron, said ninth T-pentahedron and said twelfth T-pentahedron, with block faces of said fourth T-tetrahedron disposed in facing relationship to block faces of said eighth T-pentahedron, said ninth T-pentahedron and said twelfth T-pentahedron, respectively; and
- (u). a fourth T-tri pyramid provided in said tetrahedron above said fourth T-tetrahedron and at a fourth vertex of said tetrahedron, with a block face of said fourth T-tri pyramid disposed in facing relationship to a block face of said fourth T-tetrahedron.